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PUBLISHERS' ANNOUNCEMENT.

We take pleasure in announcing that on May 1, Dr. Morton G. Lloyd of Washington, D. C., will assume the post of technical editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

Dr. Lloyd is well known as an authority on electrical and kindred scientific subjects, and he will make a valuable accession to the field of technical journalism. In scholarly attainment and in training Dr. Lloyd is well fitted to act in this capacity.

After being graduated from the Central Manual Training School in Philadelphia, he took the electrical engineer's course at the University of Pennsylvania, and was graduated with honors. He was appointed Hector Tyndale fellow in physics, and for three years pursued graduate studies in physics, mathematics and chemistry at Pennsylvania, Harvard and Berlin (Germany). During summer vacations he worked for the Cutter Electrical Company, the New York Telephone Company, the Electric Storage Battery Company, the Baldwin Locomotive Works, and in other manufacturing institutions. He was instructor at the University of Pennsylvania from 1899 to 1902. In 1902 he was appointed laboratory assistant at the Bureau of Standards, Washington, D. C., and was promoted steadily to associate physicist in charge of the section of magnetic testing. His previous work in the Bureau was in the section of electrical instrument testing. The University of Pennsylvania has conferred upon him the scientific and technical degrees of Bachelor of Science, Doctor of Philosophy, and Electrical Engineer.

He has been a prolific contributor to the technical press, and besides papers published in the Bureau of Standards bulletin and in other technical journals, he is the author of the "Transversal Thermomagnetic Effect in Bismuth," "The Galvanomagnetic and Thermomagnetic Effects in Tellurium," "Does Magnetization Alter Mass?" etc. He holds membership in the American Electrochemical Society, the American Institute of Electrical Engineers, the American Physical Society, the American Association for the Advancement of Science, the Société Francaise de Physique, Philosophical Society of Washington, and other scientific institutions.

MINIMUM MOTOR RATES.

In a certain city the rate for electric energy for motive power ranges from ten down to less than two cents per kilowatt-hour, according to the amount used per month. The electrical supply company in this city makes minimum monthly rates for power service as follows: one-horsepower motor $3, five-horsepower $8, ten-horsepower $15, fifteen-horsepower $20, and motors of twenty-five or more horsepower rated capacity $1 per horsepower per month. Where the energy used by the motors of any consumer amounts to more than the minimum rate on these motors in any month, at the regular rates, no minimum charge is made.

On the other hand, each consumer must pay the minimum rate on his motors whether any energy is used or not.

During a recent year, the above electrical supply system had about sixty power customers, and of this number there were thirty, or about one-half, that paid minimum motor rates for one or more months of the year. The minimum motor rates of these thirty power customers ranged from $84.60 down to $2.70 per month each, and nine of these customers had minimum rates of $25 or more per month. Six of the thirty power customers paid minimum motor rates in every month of the year, and the remainder paid minimums in one to eleven months each.

Of the thirty customers that paid minimum motor rates at some time during the year, one had a minimum monthly rate of $84.60, one of $77.40, one of $67.50, one of $45, and four customers had minimum monthly rates between $30 and $40.

The customer with the minimum rate of $84.60 paid this in one month, the customer with the minimum of $77.40 paid it in nine months, the customer with the minimum of $67.50 paid it in seven months, and the customer with the $45 minimum paid it in three months.

The largest total amount of minimum motor rates paid during the year was $696.60, by a foundry company that had the monthly minimum of $77.40 during each of nine months. A cotton-yarn company paid minimum rates amounting to $472.50 during the year, represented by $67.50 per month for seven months. Minimums amounting to $76.50 for two months were paid by a machine company, and a maker of machine tools paid a total minimum during seven months of $220.50.

For some of the other customers the minimums amounted to $51.52 in twelve months, to $54.50 in twelve months, to $64.80 in nine months, to $72.00 in two months, to $84.60 in one month, to $86.40 in twelve months, to $121.50 in nine months, and to $135 in three months, respectively. The six customers that were constantly on the minimum rates paid from $32.40 to $86.40, respectively, for the twelve months.

Among the thirty customers that paid minimum rates, the largest single excess during the year of the total minimum paid over the value of the electric energy consumed by the motors, at the regular meter rates, was $98.29 paid by the foundry company whose minimums aggregated $696.60. In this case the charges for energy for the months when the minimums were paid were thus increased sixteen per cent to make up the total minimum. The next largest excess of minimum over energy rates was $95.43 paid by the cotton-yarn company that had a total minimum of $472.50, so that the minimum rate increased the energy charge by twenty-five per cent. For the company manufacturing machine tools the excess of minimum over energy rates was $76.65, and the total minimum rate of $220.50 was thus greater by fifty-three per cent than the bill would have been at the energy rate. For a foundry company the total minimum rates during two months were $72, and this sum was $45.43, or 174 per cent, greater than the charge would have been on the basis of energy rates alone.

In the case of a brick company, the total minimum rate of the year was $72.50 paid during three months when no energy was used, so that the minimum exceeded the energy rate by the entire charge. For eleven customers out of the thirty that paid minimum rates, the amount of the minimums was more than double what the energy charge would have been in the months when the minimum rates were paid.

During the year, the thirty customers paid a total of $2,694.11 in minimum motor rates, and this sum exceeded by $844.80, or 45.6 per cent, the amount that the energy used in their motors would have cost at the regular meter rates for current. While no attempt is made here to draw conclusions from the above data, they evidently have important bearings on the working of minimum motor rates.

ELECTRICITY AND THE MOTOR BOAT.

While a great deal of attention has been paid to the electric vehicle as a customer for central-station service, the motor boat appears to have received very little notice, much less indeed than its worth as a prospect would seem to warrant. As the season is fast approaching when the multitudinous lakes and rivers of this country will be literally swarming with these popular craft, a few words as to their potential value to the central-station man will be of interest.

At the present time there are comparatively few electrically driven motor boats in this country, owing perhaps to the fact that the gasoline launch was first in the field and to the excellence of design and workmanship of this type of boat. But the field of the electric boat is rapidly increasing, and if central-station managers can work hand in hand with the manufacturers, as many of them are doing already in the case of the electric automobile, the number of electric launches will quickly be augmented. As a

vehicle for filling in the valleys of the central-station load curve, in a time too when the demand on the station for electric lighting is at a minimum, the electric motor boat should prove second only to the electromobile in communities situated near navigable waters.

Incidentally it may be well to point out a few of the advantages of the "electroboat." The ease in starting, the absence of trouble in running, of odors, dirt and grease, and of the objectionable chug chug of the gasoline motor launch, are all in favor of the electrically driven boat which should prove as popular with the ladies from these considerations as is the electric vehicle. Practically no expert attention is necessary in manipulating the craft, and by using duplicate sets of batteries no waiting is made necessary for charging. Another point worthy of mention is the fact that electric lighting can be adopted, thereby eliminating the dangers incident to flame illumination where gasoline is being used, and doing away with the care and attention needed by other forms of lighting. Electric lighting also lends itself readily to decorative effects at night time, and this feature should tend to popularize the electric craft for motor-boat carnivals.

The field for the central-station man, however, is not by any means exhausted by the all-electric boat. One of the chief desiderata of the gasoline launch is the ignition system. For the electric ignition in a gasoline engine, a short "fat" spark is essential to good running, and this is admittedly best obtained by means of the storage battery. Although the revenue obtainable from charging storage batteries for ignition purposes of a single motor boat is insignificant in itself, the total revenue from a whole community of motor-boat enthusiasts is quite appreciable, and, what is more important, it gives these people an acquaintanceship with the central station which should lead to other business which probably could not otherwise be obtained. For instance, what is more natural for a motor-boat owner, once he has the habit of calling on the central station for charging his ignition batteries, than to adopt electric lighting on his little vessel? A little judicious soliciting would in most cases speedily convince him of the advantages of such a procedure, for reasons previously related. And again, when he finally decides to make a change, it should not be difficult to demonstrate to him the peculiar merits of the all-electric boat. Electric boats are quite numerous and very popular on the Thames and other waterways in England, so why not here? But no business ever increased very quickly by sitting down and waiting for customers to come along of their own accord, so that the only alternative is to "go out and get them." One satisfied customer is usually an active booster on his own account, and once the ball is started rolling and kept moving, so to speak, results will speedily be attained in a way that is positively surprising.

In this connection it is hardly necessary to point out the fact that in soliciting for and catering to the motor-boat business the services of an expert are as necessary as in the automobile business.

For pleasure craft of a size large enough for cruising purposes, the storage battery of itself will probably not be convenient or sufficient. Such vessels, however, will find storage batteries for lighting and supplementary power purposes of great value, used of course in conjunction with a dynamo driven by the main engine. It is in the moderate-sized motor boat, therefore, that the central-station man will find his great field, and by employing judicious methods of exploitation he should speedily develop additional business which will make an appreciable and profitable addition to his revenue.

AN INSTANCE OF PUBLIC-SERVICE CORPORATION PUBLIC-SPIRITEDNESS.

An instance of the public-spiritedness of public-service corporations is reported from Little Rock, Ark. Although commercial advantages will probably accrue to the company mentioned in this connection, there is no doubt of the genuineness of the efforts that the corporation is making to secure by legitimate means the good will of the community it serves.

The following is reprinted from a recent issue of the Little Rock (Ark.) *Gazette*, and appeared under the caption "The Car Company Does Its Part."

"We noted recently in these columns that the street-car company and the two telephone companies at Kansas City had taken good blocks of stock in that $1,000,000 company that has been formed to navigate the Missouri river. We are glad to recall what the Little Rock Street Railway and Electric Company has done for public movements in this city. The street-car company subscribed for one-seventh, or $5,000, of the stock of the Little Rock Packet Company, took one-sixth of the baseball company's stock and has pledged $1,000 for the Confederate reunion if Little Rock gets that event. It is also the largest contributor to the Permanent Entertainment Fund and frequently furnishes free rides to delegates to conventions. General Manager Hegarty went to Mobile at the company's expense with Secretary Longley of the Retail Merchants' Association and Passenger Agents Hollenbeck and Sloat to secure Little Rock's headquarters and is a member of the committee that is trying to get the reunion for Little Rock.

"Of course you may say that the street-car company makes money out of the enterprises it subscribes money in aid of. But the point is that some corporations and individuals that make money out of public enterprises nevertheless refuse to subscribe a cent in aid of them. The street-car company does its duty by its town." Good for Little Rock!

St. Louis Convention of The National Electric Light Association.

The National Electric Light Association will hold its thirty-third anniversary at St. Louis, Mo., May 23, 24, 25, 26 and 27. The sixteenth convention was held in that city February 28-March 2, 1893, so that the association returns after an absence of seventeen years. The intervening period has seen marvelous strides in the central station art and in the growth of the Association, then with a total membership in all classes of 250. Today the Association is over 5,000 strong.

The meetings of the association will be held in the new Coliseum, a beautiful, substantial structure of brick, steel and cement, absolutely fireproof. There will be three auditoriums, ranging in capacity from 1,200 to 300 seats. There will be the main and technical sessions and sessions of the accounting and commercial sections. There will also be meetings of the new power transmission section. Some of these meetings will be held in parallel, to permit the disposal of business. It is also proposed to devote a special meeting to a gathering of the company sections, now so active and numerous and comprising a large part of the classes B and E membership.

The business headquarters will be located in the Coliseum, which affords excellent facilities for committee meetings. The secretary's office will immediately adjoin the main auditorium and will be directly accessible from the exhibition floor of the hall. At the entrance to the hall, a large space has been reserved for lounging and conversation, and ample provision has been made for registration and distribution and care of papers. The association will itself have spaces reserved also for its working staff, for the press engaged on the daily Bulletin, for an exhibit of the question box methods and for exhibits from the meter and accounting committees.

The exhibition of class D members will undoubtedly be a notable and memorable feature of the convention. The ninety-two booths provided have all been practically taken at this writing, and the display of apparatus will exemplify the progress of the art in the quarter of a century. The Coliseum lends itself most admirably to exhibit purposes, and it is believed that the whole industry will derive a marked stimulus from this plan, now being worked out.

The latter part of May is an agreeable season of the year in St. Louis, and it is proposed to arrange for one or more outdoor entertainments. The League of Electric Interests has the matter in hand, and the local committee, under the chairmanship of Alten S. Miller, president of the Union Electric Light and Power Company, is cooperating with the Convention Committee to insure the enjoyment by all of the cordial hospitality of the South. Through the courtesy of President McCulloch, of the street railway system, the badges of members will be recognized for free travel on all cars during convention week.

Owing to the growth of the association, there are now few cities in the Union that can take care of its annual meetings with an attendance of between 2,000 and 3,000. St. Louis is one of them, and the hotel managers have positively guaranteed no advance in rates, but applications should be filed immediately with the hotel preferred, as reservations are being made rapidly. Any special inquiries should be addressed direct to Lyman T. Hay, chairman of the Hotel Committee at St. Louis.

George H. Porter, the veteran master of transportation, is now busily engaged in preparing the various details of the transportation arrangements and of special trains. It is specially hoped to secure a large attendance from the South and Southwest, and all points to which the great city of St. Louis serves as a distributing center.

Commission News from New York.

The New York Public Service Commission, Second District, has made an order requiring the International Railway Company to carry only interurban passengers on Lancaster cars. Complaints have been made to the commission of the service by the Business Men's Association of Lancaster, former senator William F. Mackey, and other residents of Lancaster and Depew. At the hearings it developed that one of the chief causes of delay in the operation of cars between the city of Buffalo and Lancaster was the carriage of city passengers.

The order provides that all Lancaster cars operating east-bound between the starting point at the junction of Main and Clinton streets in the city of Buffalo and Lancaster, N. Y., shall stop at all streets and regular stopping places in the city of Buffalo to receive and take on interurban passengers only. Lancaster cars operating west-bound shall stop at all streets and regular stopping places in the city of Buffalo between Broadway city line and the junction of Main and Clinton streets in the city of Buffalo for interurban passengers to alight only.

The cars are also to be provided with signs reading: "No city passenger carried on this car."

The Commission has authorized the East Creek Electric Light and Power Company to make a first and refunding mortgage upon all its property, estates and franchises to the New York Trust Company to secure the payment of $3,000,000 of fifty-year five per cent bonds. The company is authorized to issue at present $1,750,000 in bonds at not less than eighty-five, proceeds to be used to retire outstanding bonds, the payment of obligations, the purchase of additional lands and water power, new power plant and additions generally to its property.

The company is authorized to increase its capital stock from $200,000 to $500,000 and to issue the additional $300,000 of stock for the payment of moneys advanced, organization expenses and the purchase of additional lands for East Creek development.

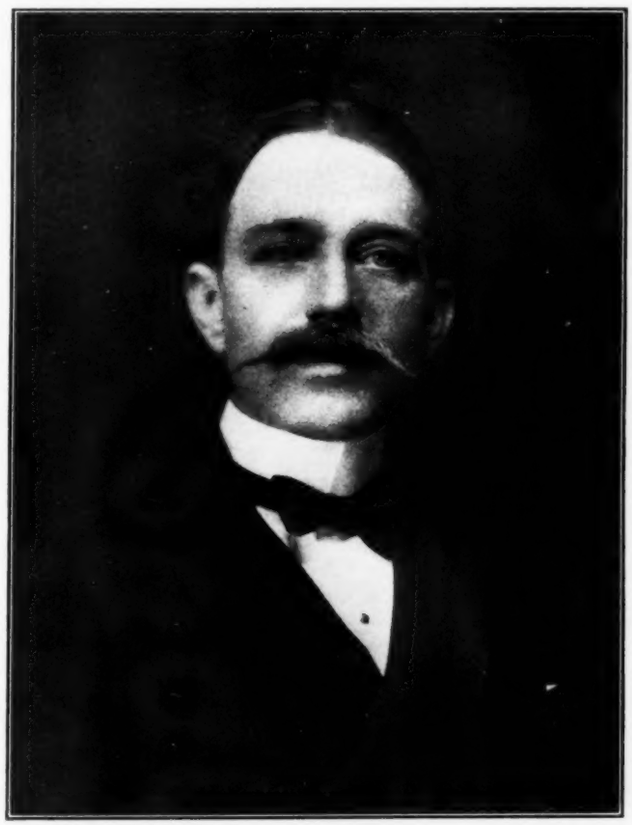
The East Creek Company is now engaged in generating electricity at its power plant in East Creek and selling and distributing the same at St. Johnsville and also in selling and distributing electricity at Fort Plain, Nelliston, Canajoharie and Palatine Bridge for public and private use.

Ex-governor B. B. Odell, president of the Orange County Traction Company, appeared before the commission recently and gave testimony in support of the application of his company for authority to execute a mortgage for $750,000 and to issue bonds thereunder for the same amount. The company asked for the issuance of $205,000 in bonds at the present time. Danforth E. Ainsworth, of Albany, was attorney for the company.

The applicant operates an electric street railroad in the city and town of Newburgh and the town of Montgomery, N. Y.

Peter Cooper Hewitt.

Born to riches, occupying an eminent social position, for years an active member of an extensive and enterprising manufacturing firm, Peter Cooper Hewitt has found time to devote arduous effort to the development of scientific apparatus and to deep physical research in the study of the obscure phenomena of alternating electrical currents. He has given to the world three great inventions—the mercury-vapor lamp, the mercury-vapor rectifier, and the mercury-vapor interrupter. In this connection his studies and publications on the "negative electrode resistance" have been of the greatest scientific importance. Beyond his work on the purely scientific side he has been a patient and painstaking laborer in bringing about the practicable application of his inventions, and he has done much in the development of new ideas in motor-driven vehicles and in aviation. His mercury-vapor interrupter may eventually become one of the most useful adjuncts in syntonic and selective wireless telegraphy, and his rectifier has a field limited only by the number of its possible applications. His patents upon this apparatus, filed in 1901, have just been upheld in a decision handed down last week, granting to him the claim of priority, and declaring him the discoverer of a fundamental principle in electrical science, for the rectification of alternating current to a unidirectional current.



PETER COOPER HEWITT,
Engineer and Inventor, Awarded Patents Last Week on His Mercury-Vapor Rectifier.

It is hardly fair to lay a man's genius and ability to inherited tendencies. The grandson of one of the most useful men the world has known, and the son of one of the most famous citizens of New York, it is due to his own initiative that he did not adopt a life of leisurely indulgence, but sought rather to emulate the lives of his illustrious forbears and live up to the accomplishment of "Whatsoever things are true."

Peter Cooper Hewitt was born in New York city on March 5, 1861. He is the son of Abram Stevens and Sarah A. (Cooper) Hewitt; a grandson of Peter Cooper, philanthropist, friend of Field and father of the first American cable, builder of the first American locomotive, pioneer iron founder, founder of the glue business in this country and founder of the Cooper Union for the Advancement of Science and Art in New York City. Mr. Hewitt was educated at Stevens Institute of Technology and Columbia University, and for a long time was actively engaged with the firm of Cooper Hewitt & Company. He is a member of the American Institute of Electrical Engineers, American Physical Society, New York Electrical Society, and the New York General Society of Mechanics and Tradesmen. He is a member of the Union, Knickerbocker, Manhattan, Metropolitan, Racquet and Tennis, Brook, Lambs, Turf and Field, Automobile of America, Tuxedo, Players, Century, and Engineers clubs. That Mr. Hewitt finds time to attend to social matters, as evidenced by his club membership, is an instance of the many-sidedness of his character.

The St. Louis League of Electric Interests.

The League of Electric Interests of St. Louis had as its guest of honor at a dinner at the Mercantile Club on April 21 last, Henry L. Doherty, president of the Doherty Operating Companies of New York, N. Y. The subject of his address was, "Is the Quasi-Public Corporation Properly Treated by the Public?" The subject had been carefully studied and was capably handled. Capt. Robt. McCulloch, president of the league, presided. Other guests of the league were Frank W. Frueauff, president of the National Electric Light Association; T. Commerford Martin, secretary of the National Electric Light Association, and H. H. Scott, chairman of the Membership Committee of the association. Among those in attendance were Hon. F. H. Kreisman, mayor of the city of St. Louis, all of the members of the Public Service Commission of the city and the presidents of many of the civic organizations. About twenty managers of central stations from the surrounding territory of Missouri, Illinois and Arkansas were also present as the guests of the league. About 150 members in all were present.

The St. Louis Electric Show, to be held May 28 to June 2, immediately following the convention of the National Electric Light Association, is being promoted and managed by a special show committee appointed by the League of Electrical Interests and working in connection with the executive committee of the league. This is said to be the first electric show conducted on a strictly co-operative basis for the benefit and profit of the exhibitors.

Indianapolis Traction Deal.

Announcement is made that the Terre Haute, Indianapolis & Eastern Traction Company has purchased a majority of the stock of the Indianapolis Traction & Terminal Company. The latter company is capitalized at about $5,000,000.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

PROGRAMME OF THE SAN FRANCISCO MEETING, MAY 5, 6 AND 7, 1910.

The success of the Southern Convention of the American Institute of Electrical Engineers, at Charlotte, N. C., portends an equally enthusiastic and successful meeting at San Francisco on May 5, 6 and 7, 1910. As previously announced, the meeting will be under the auspices of the High Tension Transmission Committee, of which Ralph D. Mershon is chairman. The members on the Pacific coast have been very active in their preparations for this meeting, and through their efforts, some of the features arranged for will be of unusual interest. In San Francisco visitors will be given an opportunity for sight-seeing trips around the city, which will include visits to the local generating stations, and the Entertainment Committee has arranged for special parties to visit points of unprofessional interest. On the evening of May 6 the San Francisco Section will give a reception to President Lewis B. Stillwell and the visiting members. The Pacific Gas and Electric Company has very kindly arranged for a tour of inspection of several of its mountain plants, and will provide special transportation and entertainment for those making the trip. The party will leave San Francisco on the evening of May 8, and in the course of the tour will make a side trip to the Big Bend plant of the Great Western Power Company, as guests of the latter company. The entire trip will require four days. Arrangements have also been made for members who visit Seattle, Portland and Los Angeles, to be be accorded the privilege of inspecting electrical plants in these cities.

The technical papers to be presented are as follows:

"Emergency Generating Stations for Service in Connection with Hydroelectric Transmission Plants Under Pacific Coast Conditions," by A. M. Hunt, electrical engineer, San Francisco, Cal

"Hydroelectric Power as Applied to Irrigation," by John Coffee Hays, consulting engineer, and president, Mt. Whitney Power Company, Visalia, Cal.

"The Developed High-Tension Network of a General Power System," by Paul M. Downing, engineer, Operation and Maintenance Department, Pacific Gas and Electric Company, San Francisco, Cal.

"Parallel Operation of Three-Phase Generators with Their Neutrals Interconnected," by George I. Rhodes, assistant engineer, Interborough Rapid Transit Company, New York city.

"Observations of Harmonics in Current and in Potential Wave Shapes of Transformers," by John J. Frank, assistant engineer, Transformer Department, General Electric Company, Pittsfield, Mass.

"Transmission-Line Crossings of Railroad right-of-Way," by Allen H. Babcock, electrical engineer, Harriman Lines, San Francisco, Cal.

The professional sessions will be held in the auditorium of the Home Telephone Company Building, 333 Grant Avenue, San Francisco, Cal.

The Institute will be officially represented by President Lewis B. Stillwell, and Secretary Ralph W. Pope, of New York.

Non-members, as well as members, are cordially invited by the American Institute of Electrical Engineers to attend this meeting.

Railway Conference in Switzerland.

There will be an International Railway Conference, at Berne, Switzerland, beginning July 4. Commissioners Lane and Clarke will represent the Interstate Commerce Commission, and other noted Americans who will be members of the conference are Fairfax Harris, vice-president of the Southern Railway Company; W. A. Garrett, formerly general manager of the Sea Board Air Line; J. A. Brown, vice-president of the Railway Equipment and Publication Company; H. S. Haines, formerly president of the American Railway Association; W. F. Schleitzer, president of the Railway Track and Supply Association of the United States; C. A. Severence, attorney at law, and William C. Kuntz, of the Pennsylvania Company. F.

Joint Telephone Convention.

The Toll Line Clearing House Associations of Indiana and Michigan, connected with the Independent Telephone system, will meet in South Bend May 11, when the state telephone associations of Indiana and Michigan hold their joint convention May 11 and 12. Three hundred representatives of the independent telephone movement from the two states will be present. The president and other officials of the National Association will be in attendance. Matters of great importance in the way of local service in the two states will be discussed and it is believed the situation in Indiana relative to the Morgan interests will be analyzed.

The headquarters will be in the Oliver Hotel, where a banquet will be held on the evening of May 11. Theodore Thorward, president of the South Bend Home Telephone Company, is working hard to make it the greatest telephone convention ever held in the state.

Florida Electric Light and Power Association.

The annual convention of the Florida Electric Light and Power Association was held in Tampa, Florida, April 12 and 13.

The first meeting was called to order by President H. A. Grant. Welcome to Tampa was extended by City Attorney Rowland, and response was made by President Grant. After a short session the meeting adjourned to the pavilion at Ballast Point, where H. C. Russell read a paper on "Single Phase Motors," S. D. Collins read a paper on "Tungsten Lamps," and L. Callender talked on "Heating Appliances."

In the evening a Rejuvenation of the Sons of Jove was held and a large class initiated. At the banquet which followed several interesting talks were made and a very enjoyable time spent.

At the Wednesday morning session a very interesting paper was read by J. W. Smiley entitled "Central-Station Business Getting."

During a brief afternoon session the following officers were elected for the ensuing year: F. E. Fletcher, president; W. C. Bostwick, vice-president; and H. C. Adams, secretary-treasurer.

It was decided to hold the convention of 1911 in Jacksonville, Fla.

A big trolley party, including members of the Utica, N. Y., Chamber of Commerce, and prominent interurban railway officials of the state, will visit Toledo, Ohio, on May 19.

The Street Railway System of the City of Lyons, France.

Description of a Line Recently Converted to the Single-Phase System.

BY ALFRED GRADENWITZ.

In view of the ever increasing extension of the tramways leading to its suburbs, the city of Lyons, France, recently converted the whole of its tramway lines to the single-phase system, thus avoiding the rather expensive feeders and rotary-converter stations formerly used, while eliminating any risk of exceeding the admissible maximum distances of a direct current system.

In order to facilitate rapid transit all the suburban lines were led as far as the center of the town; as, however, on account of official regulations no high-tension conductors could be installed in the interior of Lyons, and as the urban tramway system already existed as a direct-current system, all the rolling stock had to be designed so as to lend itself both for direct-current operation at 600 volts, and for alternating current operation at a pressure of 6,000 volts.

The French Westinghouse Company was entrusted with this interesting conversion. Two lines were installed at the beginning. The line leading to the suburb of Miribel is at present 12.5 kilometers in length, of which five kilometers are situated within the direct current zone; this line is to be further extended as far as Montluel, thus reaching a total length of twenty kilometers. It is installed on the highway throughout its length, traversing several suburbs. The tramway line leading to Jons is twenty-one kilometers in length, of which six kilometers are on the direct-current system. This line is shortly to be extended as far as the town of St. Bremaz, at a distance of sixty kilometers from Lyons; it likewise passes through several townships. Both lines are built on the same plan.

The line poles on the highway sections as well as on curves of considerable radius and at turnouts (Fig. 2) are made of Mannesmann steel tubes and are able to stand a pull of 800 kilogrammes at the top. In the open country, as well as in curves of small radius there are, however, installed line poles of double T-iron (Fig. 3) which have given excellent results in practice. On straight lines the poles are placed from thirty-five to fifty-four meters apart. The conductors are generally supported from brackets as in Fig. 2; on several road sections, as well as in multiple-track switching (Fig. 4), the span-wire construction was chosen, however. The connection with some switches comprising curves of small radius the span wires are replaced by channel irons (Fig. 3). The brackets

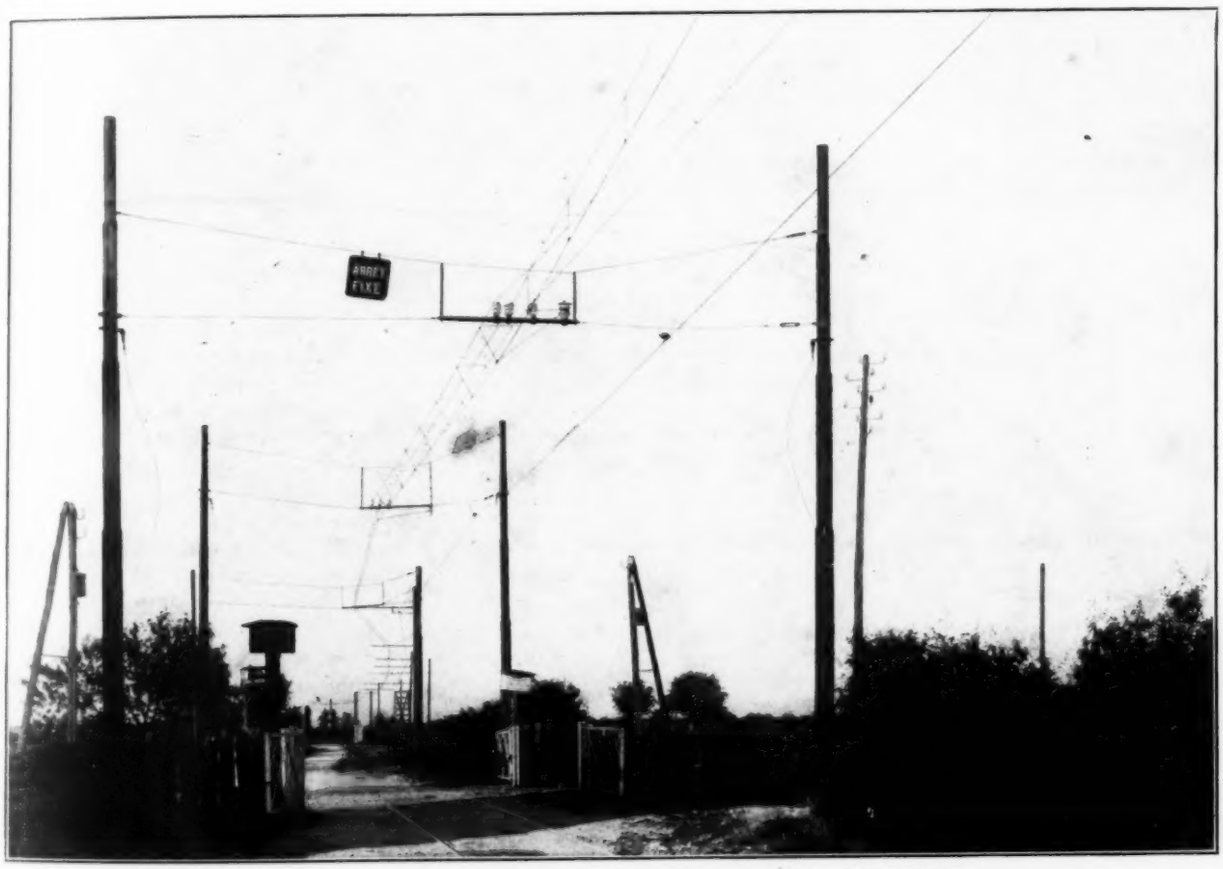


FIG. 1.—ROAD PASSAGE, SHOWING SINGLE AND DOUBLE CATENARY SUSPENSIONS.

supporting the conductors are of the tubular type. For the sake of uniformity, the same type of tube has been used in connection with these brackets as well as with the wire suspension of the span-wire arrangement shown in Fig. 4.

The catenary type of trolley-wire

FIG. 2.—STRAIGHT LINE AND TURNOUT.

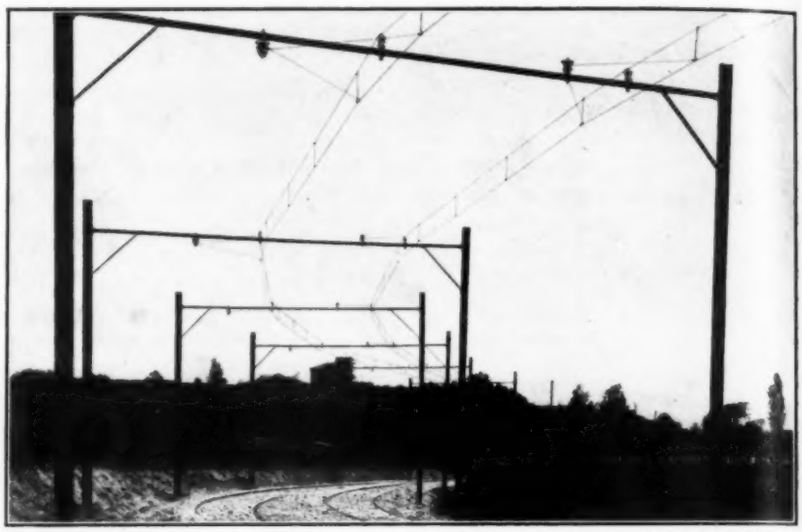


FIG. 3.—CATENARY CONSTRUCTION ON SHORT-RADIUS CURVE WITH TURNOUT.

suspension was chosen throughout. The main insulators fixed on the brackets are made of porcelain triple petticoated; each insulator was tested previous to its being installed, at a tension of 50,000 volts. To the insulators is fixed a steel messenger cable consisting of seven strands which by means of flat iron hangers carries the fifty square-millimeter hard-drawn copper trolley wire of figure 8 cross section. The hangers, which are fixed on the steel cable by means of a bow, grasp the copper wire by means of a bolted grip. In order to keep the cable and the trolley-wire permanently in a vertical plane the conductors are provided at curves, and also at some straight-line sections, with steadying arms preventing any oscillation. These arms are either rigid (Fig. 2) or flexible (Fig. 3) according to local conditions; they are fixed on insulators which resemble the main insulators closely. All the poles are installed in concrete foundations, and are carefully grounded by rail connection.

Each of the lines is subdivided into sections about three kilometers in length which are carefully insulated from one another. At each section point is arranged a small cabin (Fig. 5), which contains an oil switch, a lightning arrester and resistance, and an attachment for gounding the section in case of any urgent repair work.

On account of their considerable distance from the substation, the single-phase lines are fed by two feeders 6.5 and 4.5 kilometers in length, respectively, at 6,000 volts tension and fifteen cycles. The direct-current lines are fed in the town itself at the terminal station. A dead neutral section is inserted between the direct-current and alternating-current lines, with a view to facilitate transition (Fig. 6). The direct-current line is of the normal type with single conductors.

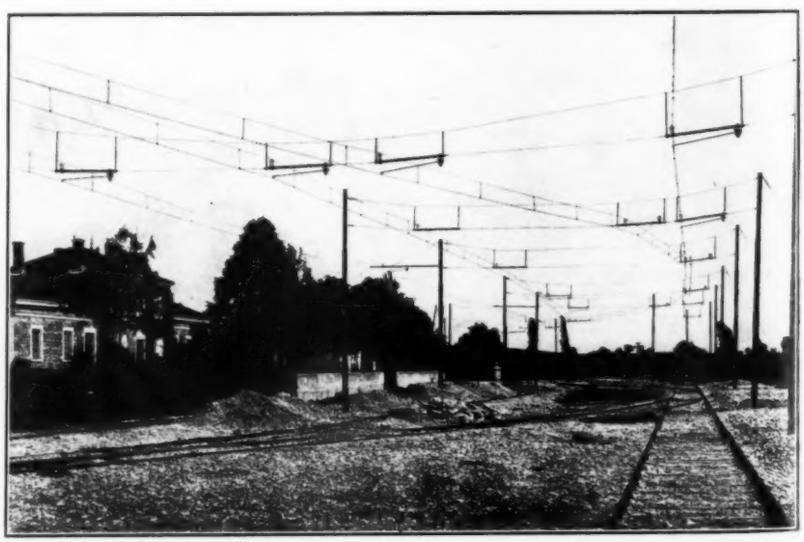


FIG. 4.—CATENARY CONSTRUCTION WITH CROSS-OVER IN STATION.

The tramway cars are constructed as follows: The motor cars comprise Brill trucks for standard-gauge tracks. The distance between the two axles of the same track is 1.21 meters. The total length of each under-frame is 10.9 meters, its breadth being 1.83 meter. The driving wheels are 0.85 meters in diameter. Each car comprises first and second-class compartments, separated by a platform affording standing accommodation. Their total capacity is fifty passengers. The small driver's platforms arranged at the front and back are inaccessible to passengers. Each car contains the following electrical equipment: Two motors, two controllers, one transformer, one commutator, a resistance lightning arrester for high and low tension, circuit breakers, fuses, and an air compressor. For collecting the current from the contact wire there has been provided both a pantagraph arrangement and an ordin-

ary trolley pole, the pantagraph collector not being fit for use on the old city lines.

The pantagraph current-collector arranged on the roof of the car is carried by a wooden frame mounted on insulators, the iron parts of each insulator being carefully grounded. It is actuated by means of compressed air. From the pantagraph collector a branch wire is led to a horn lightning arrester, installed, with its metal resistances, on the roof of the car. The current collected by the pantagraph passes to the circuit changer likewise fixed on the roof of the car, and which is intended to throw the current either into the high-tension or into the low-tension circuit of the car.

FIG. 5.—SECTIONALIZING CABIN.

When the car is fed with direct current, the current traverses a circuit containing the ordinary outfit of tramway cars (platform controller, platform circuit breaker, fuses, etc.). As the car leaves the direct-current system, in order to enter the high-tension alternating-current network, an arm fixed in the neutral zone between the two sections strikes against a lever of the switch fixed sideways to the car; this impulse tilts the circuit changer through a given angle adjusted so as to throw the current derived from the line into the alternating-current circuit of the car. An inverse motion occurs as the car passes from the alternating current into the direct-current system. From the circuit changer the current is led to the high-tension fuse, and thence to the transformer, the two last-named apparatus being fixed below the car. The line consists of a highly insulated cable protected by a grounded metal sheath.

The transformer is an oil insulated transformer having a capacity of fifty-five kilovolt-amperes. It is fed at the trolley potential of 6,000 volts between its outside terminals, one of which is grounded. It is designed for a number of secondary operating tensions between 100 and 315 volts which are indispensable for the starting of the motors and the regulation of their speed.

Each controller comprises three drums, two of which correspond to the direct-current system. One serves for reversing the direction of traveling, and the other for controlling the speed.

FIG. 6.—TRANSITION POINT FROM ALTERNATING TO DIRECT-CURRENT SYSTEM.

The third drum is intended for controlling the motor speed in the case of alternating-current operation. A single main crank suffices to operate the controllers; as the car travels over the intermediary section between the alternating-current and direct-current lines, the motorman simply shifts this crank to another drum. Even though he forget this operation no inconvenience to traffic would be entailed, for the car would be simply left standing on the track.

Each terminal of the low-tension end of the transformer corresponds to a given position of the alternating-current controller. The starting and speed regulation are accordingly effected by altering the tension, in the case of single-phase operation. The various positions of the direct-current drums of the controller correspond closely to those of the standard equipment of direct-current tramway cars.

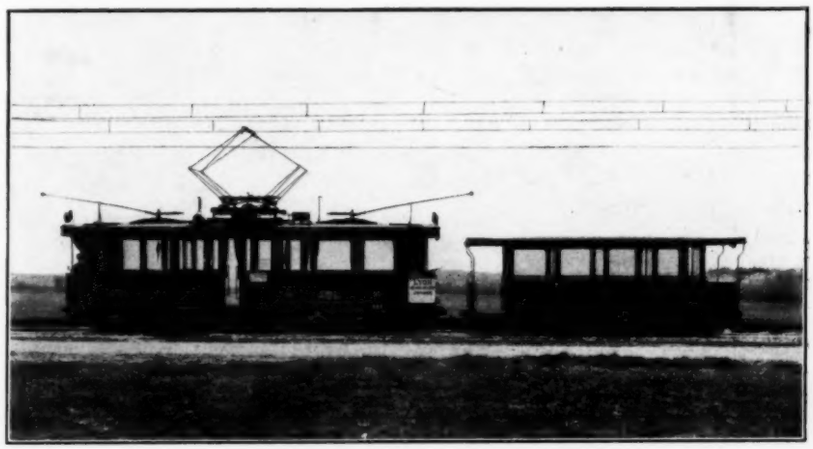


FIG. 7.—MOTOR CAR AND TRAILER.

Each car is equipped with two single-phase motors, one of which is mounted on each truck. The motors are of forty-five horsepower nominal output. They are fed at normal full load with alternating-current at 275 volts and fifteen cycles, or with 275-volt direct current; they are provided with compensating coils and commutating resistance circuits according to the Westinghouse system for single-phase traction motors. The two motors are always working in series connection in the case of direct-current operation, and in parallel connection in the case of alternating-current operation.

The cars are equipped with Westinghouse air brakes, the compressed air required for their operation being generated by a small compressor operated by a five-horsepower motor designed both for alternating-current and direct-current operation. Between the compressor and the braking cylinders there is arranged an air reservoir. This en-

tire machine set is installed below the car floor beside the transformer. Fifteen cars of this kind have been built.

The substation serving to feed the high-tension alternating-current system is situated beside the direct-current substation and one of the car sheds. The switchboard comprises eight panels, viz.: seven low-tension and one high-tension panel. All the switching and controlling apparatus mounted on the marble slabs is designed for low-tension, and only the back part, locked by a grating, contains the high-tension apparatus.

The substation converts the direct-current it receives into single-phase alternating current of fifteen cycles and 6,600 volts. This conversion is effected by means of a motor-generator set consisting of a 300-horsepower, 450-revolutions-per-minute direct current motor, which is coupled diectly to a 225-kilovolt-ampere alternating-current generator direct-connected to its exciter. In the substation are at present installed only two such sets, one of which serves as stand-by; only on days of special rush are they worked in parallel.

In connection with tests made on delivery, a maximum speed of fifty kilometers and an average speed of twenty-four kilometers per hour were obtained. The average speed is quite good for a suburban tramway, which like this is installed alongside the highway, thus entailing a frequent slackening of speed and stoppage. The excellent condition of the current collectors and the slight supervision they require likewise deserve general interest.

Hydroelectric Legislation in Canada.

The Canadian Government has recently decided not to disallow the hydro-electric power legislation passed by the Ontario government last year. The matter has been under consideration since the application had been made last summer for the disallowance of the act by representatives of private power companies at Niagara and of private individuals in western Ontario, who objected to the conditions under which the hydroelectric commission was allowed to run power lines through their lands.

The chief objection taken to the act, says the Winnipeg *Free Press*, was, in brief, that it was an unconstitutional infringement on vested rights, in which millions of dollars of private funds had been invested on the understanding that there would be no competition from government-owned and operated power lines; that injury was thereby done to the credit of the whole Dominion as a field for investment in similar projects by foreign capitalists, who would henceforth hesitate to invest money in Canadian undertakings through fear of subsequent government competition, and that the conditions imposed with regard to the usurpation of private rights were generally arbitrary and unconstitutional, principally in view of the fact that the right of appeal to the courts had not been granted.

Under the provisions of the British North American Act, the federal government had a year from April 20, 1909, within which to disallow it. In recommending that the act be disallowed, the minister of justice took practically the same ground as was taken in the case of the Cobalt Lake legislation of the Ontario government two years ago.

It is further stated that there does not seem to be any valid cause made out showing that the legislation complained of has injuriously affected the credit of the Dominion as a field for foreign investment. Any complaint in this respect would more properly lie against the provincial government's power scheme as a whole in respect to its competition with private enterprises already established.

The Glidden Tourists and the Telephone.

To the Editor:

In your April 16 issue of the Electrical Review and Western Electrician, on page 800, under article entitled "Glidden Tourists to Use Wireless," you make the statement that "Owing to the fact that the Glidden automobile tour this year is routed through a section of country where telegraph and telephone facilities are very poor, it has been decided to equip the cars with wireless outfits in order to enable the contestants to report accidents, etc., and to keep in touch with the authorities of the tour and with the towns ahead. The innovation will be watched with interest."

We admit that this article is interesting in that it brings in a new feature, to-wit, "the wireless telephony," but for a very large portion of the route the statement about the scarcity of telephone development is not at all borne out by facts. As we understand it, the tourists start at Cincinnati. From just across the river in Kentucky, on down through the famous bluegrass section of the State through Lexington, the State Capital at Frankfort, Louisville, thence via Bardstown, New Haven, Cave City, Glasgow Junction, Bowling Green, Franklin, Ky., through Portland and Gallatin to Nashville, then by Franklin, Columbia, Mt. Pleasant, Lawrenceburg, Tenn., and on through Florence, Tuscumbia and Sheffield, Ala., to Iuka, Corinth, Grand Junction and Colliersville to Memphis, Tenn., then into Mississippi by way of Tunica and Coahoma to Trotters Point, just opposite Helena, Ark., the tourits follow constantly and without interruption the long distance lines of the Cumberland Telephone & Telegraph Company, a total distance of nearly 800 miles. We seriously doubt if it would be possible to find any section of equal mileage anywhere in the world where the telephone development is better than the first 800 miles that the Glidden tourists propose to cover in the approaching annual tour. It is true that there are vast undeveloped resources and vast possibilities awaiting the further development of the southland, but to convey to your readers the idea that Kentucky and Tennessee do not compare in telephone development to other states in the Union in proportion to population is not in accordance with the true conditions. At any rate, it can all be summed up as far as the Glidden tour is concerned by the statement that as long as the tourists are traversing that portion of the route in the States of Kentucky, Tennessee, Alabama and Mississippi, the cars never leave the lines of the Cumberland Telephone and Telegraph Company. A test set with proper connections could be attached to either local or long distance lines anywhere en route, and put the tourists in quick voice with New York, Chicago or New Orleans and intermediate points.

Leland Hume.

Arc Lighting for Railroad Yard.

The Allentown (Pa.) Electric Light and Power Company has closed a contract with the Central Railroad of New Jersey for the complete lighting of its enlarged yards between Allentown and Bethlehem by means of arc lamps, and is now proceeding with this work with a large force of men.

Banquet of the Pittsburg Section of the American Institute of Electrical Engineers.

The accompanying illustration was taken at the banquet of the Pittsburg Section of the American Institute of Electrical Engineers, held at the Fort Pitt Hotel, Pittsburg, Pa., Friday, April 8, 1910.

C. B. Auel was the toastmaster and introduced the following speakers: Charles F. Scott, past president of the Institute, who spoke on the "Pittsburg Section"; Lewis Buckley Stillwell, president of the Institute, who took "The Institute" for the subject of his remarks; Malcom C. Rorty, manager of the Central District and Printing Telegraph Company, who took for his subject, "The Relation of the Public Service Corporation to the Public"; George C. Johnston, M. D., who gave an address under the caption, "A Little Leakage—More or Less High Tension"; and Dr. Walter Riddle, of the Sterling Varnish Company, who took the topic "Insulation" for the subject of his remarks.

BANQUET OF PITTSBURG SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The regular monthly meeting of the American Institute of Electrical Engineers in New York was postponed for a week so that Mr. Stillwell could be present at the Pittsburg banquet.

There were 330 present, which number included many ladies. A feature of the evening was the singing of popular songs by the feasters; these songs were interspersed among the toasts and helped to put everybody in neighborly good spirits.

The committee, to whom great credit must be accorded for the faultless arrangements, consisted of the following gentlemen: C. B. Auel (chairman), W. Edgar Reed, Bertrand P. Rowe, Ludwig Hommel, R. A. L. Snyder, H. N. Muller, W. E. Moore and E. B. Tuttle (secretary).

Metropolitan Street Railway.

Judge Lacombe of the United States Circuit Court handed down an order last week directing William W. Ladd, as receiver of the New York City Railway Company, to transfer to Joline & Robinson, receivers of the Metropolitan Street Railway Company, all the rights and interest of the New York City Railway Company in an agreement made May 21, 1904, between that company and the city of New York, the Bridge Operating Company, the Brooklyn Heights Railroad Company and other Brooklyn street railway companies, together with 500 shares of the capital stock of the Bridge Operating Company upon payment by the receivers of the Metropolitan company of $150,000, and the assumption by the Metropolitan company of all the obligations of the New York City Railway Company under the agreement.

The order also authorizes Joline & Robinson, for the Metropolitan company, to purchase for $150,000 in cash the property and rights referred to in the agreement and the 500 shares of the Bridge Operating Company's stock. The property and rights thus secured are by order of the court added to the property secured by mortgage to the Guaranty Trust Company and the Morton Trust Company and shall be subject to lien of both mortgages.

IOWA ELECTRICAL ASSOCIATION.

TENTH ANNUAL CONVENTION AT SIOUX CITY, APRIL 20 AND 21.

A gratifying number of central-station and railway men of Iowa and manufacturers and supply men from all parts of the country met in Sioux City, Ia., April 20 to 23, to attend the tenth annual convention of the Iowa Electrical Association, the seventh annual convention of the Iowa Street and Interurban Railway Association and the annual electric show held in conjunction with these associations.

Headquarters of the Electrical Association were established at the Auditorium and the electric show held at the same place afforded the delegates an opportunity of viewing the various apparatus displayed.

The tenth convention of the Iowa Electrical Association was in every way a fitting successor to the successful meetings which have preceded it. Notwithstanding the fact that many delegates had to come from remote points of the state, the attendance was large. An exceptionally good programme was presented and the social features planned by Sioux City and the manufacturers were in no way lacking.

President O. E. Brownell, of Lake City, called the meeting to order at 10 a. m., Wednesday, April 20, and introduced Mayor Albert A. Smith, of Sioux City, who cordially extended a hearty welcome to the delegates. As a prelude to his address of welcome, Mayor Smith referred to his electrical experience, which consisted of unpacking what is said to have been the first telephone received in Iowa.

A brief response was made by L. D. Mathes, Dubuque, and this was followed by the address of the president. After briefly reviewing the work of the association, President Brownell said that in the early days of electric development the belief was general that of all public utilities, the electric light industry was the most desirable, hence the establishment of many plants, some to be managed by municipal officers, others fell into the hands of dishonest managers, while a few were launched under good management. The plants launched under municipal management have few instances of success to point to. The plants started under favorable management are found today in the exceptional community.

Municipal ownership has, in the past, caused more or less apprehension on the part of management and stockholder, but today evidence goes to prove that vested rights are held in higher esteem than in former years and municipal governments are no longer looking upon public utilities as property which they may render undesirable by oppressive measures and then take them over at a sacrifice. They have learned through litigation that the owners of such property are recognized by the highest courts as entitled to such compensation for services rendered as will provide a reasonable earning on the investment.

In concluding, President Brownell said that the regulation of the industry by commission seems to be present in the minds of all central-station men and he alluded to the talk on that subject which was delivered later.

The reports of the outstanding committees were then read and adopted. The report of the committee on Grounded Secondaries was presented by Prof. F. A. Fish of the Iowa State College. This report gave the results of a series of tests made on several kinds of grounds.

Iron, copper and aluminum plates buried to a certain depth in both earth and charcoal, and galvanized iron pipe buried in earth were used. A 120-volt, sixty-cycle, alternating current was employed in making the tests and the resistance of each ground measured. Professor Fish reported that the galvanized iron pipe, apparently, gave the best results. After a brief discussion in which it was moved to continue the work of this committee, the report was adopted.

The appointment of the nominating committee concluded the morning session.

Wednesday afternoon session was opened with an interesting and instructive talk on "Producer Gas Plants," by Wm. H. Spiller, of Kansas City. Mr. Spiller said that the investigation of producer gas plants dates back to 1890, when there was approximately 10,000 horsepower in plants installed. Since that time the increase has been gradual and today there are gas plants installed with an aggregate capacity of 60,000 horsepower. While the gas producer plant has met with pronounced success in Europe, their comparatively slow growth here has been, according to the speaker, on account of high first cost, the unfamiliarity of Americans with such plants and the inability to secure competent operators.

Confining himself to suction gas producer plants, Mr. Spiller described them as being more economical and reliable than any other type of power producer, and to substantiate this he quoted from a report compiled by H. G. Stott of the Interborough Rapid Transit Company, comparing gas producer plants with steam plants. Mr. Spiller then drew diagrams illustrating the principles of the gas producer plant, which he likened to the simplest type of self-feeding base-burner stove.

Regarding the future of gas plants, the speaker said that if their first cost could be reduced, their growth would be remarkable, but as it is the arguments of the manufacturer are economy, reliability and ease of operation.

There being no discussion, a paper entitled "Accounting" was read by A. W. Zahm, of Mason City. Central-station bookkeeping and accounting has been a much-neglected subject by a great number of central stations; however, Mr. Zahm said that action is being started in this direction and the National Electric Light Association has a committee which is working on a system which is applicable to all classes, and he recommended that the association arrange with the national organization for copies of the report.

Mr. Zahm spoke of the classification of accounts adopted by the New York Public Service Commission. The companies are divided into four classes, according to their gross income, and the speaker referred to the system prescribed for each class.

For small central stations the speaker suggested that they open ledger accounts, devoting one of more pages to the following classifications: A, manufacturing, covering all expenses within the station, which should originally be sub-divided into five sub-accounts, such as fuel labor, boiler-room labor, engine-room labor, supplies for boiler-room, and supplies for engine-room; B, distribution, covering all expenses of distributing the current. C, general expenses, covering all office expenses.

D, miscellaneous expenses; E, stock account, and F, adjustment account.

Under the heading of depreciation which comes under adjustment accounts, the following sub-divisions were suggested by Mr. Zahm: A, complete depreciation, and B, income depreciation.

This paper was followed by the presentation of one by Professor L. B. Spinney, of the Iowa State College, entitled "Regulation and Illumination," there being no discussion on Mr. Zahm's paper.

Prof. Spinney opened his paper with the assertion that every central station manager will admit the desirability of good voltage regulation. The subject is ordinarily discussed from the standpoint of station efficiency and the life of the incandescent lamp, and the arguments afforded are sufficiently convincing to make it seem unnecessary to go farther since it can be demonstrated that excessive voltage tends to decrease the operating efficiency of the plant and the life of the lamp as well. Prof. Spinney said that it is contended by some central stations that an increase of voltage always results in an increase of light. While this is true of new lamps for a short time, it is also true that under excessive voltage the incandescent lamp rapidly falls off in candlepower. Excessive voltage also results in increased power consumption. To show the effect of excessive voltage on the life of a lamp the following figures were presented: An increase of one per cent above normal voltages reduces the life of the lamp to seventy-nine per cent of its normal life; two per cent reduces the lamp to 61 per cent; three per cent above normal reduces the lamp to forty-nine per cent of its life; four per cent reduces the life to forty per cent; five per cent reduces the life to thirty-four per cent, and six per cent above normal reduces the life of a lamp to twenty-nine per cent of its normal life. Regarding the effect of excessive voltage on illumination, Prof. Spinney said that the characteristic of the incandescent lamp is such that a small change in the voltage at which it is operated results in a relatively large change in its candlepower, and, therefore, in the the illumination derived from it. For example, a two per cent increase of voltage increases the candlepower twelve per cent, and a voltage of five per cent in excess of normal increases the candlepower thirty-one per cent. For the purpose of illustrating the importance of the lamp characteristic in this connection, Prof. Spinney exhibited charts, setting forth the regulation curves of four Iowa central stations, and the illumination curves corresponding Considering the several sources which contribute to poor regulation, the first is the regulation at the switchboard, as a variation in the switchboard regulation will effect the regulation at all points on the line. The second source of variation is the line itself. If insufficient copper has been used in the construction of the line there will be an excessive pressure drop during the period of heavy load. The third source of variation is the transformer. The first step towards improving the regulation of a plant is to make an exploration of the various lines with a voltmeter. The individual line effects should then be corrected by adding copper or by redistribution of line loads. When this has been done, and lamps of proper voltage have been placed on the various parts of the system, due attention to switchboard voltage will insure results.

There being no discussion of this paper, Adrian Tobias, of the Duncan Electric Manufacturing Company, Lafayette, Ind., presented the next paper, entitled "Meters," a brief abstract of which appears herewith:

The electric meter forms one of the most interesting elements identified with the measurement of electrical energy, and for this reason it is ever foremost in the minds of central-station managers and superintendents. It frequently happens that when a customer thinks his bill for electric light too high he immediately complains of the meter. It frequently happens, too, that the central-station manager thinks the customer justified in his kick and returns the meter to the manufacturer with the result that the latter, in nearly every case, finds the meter accurate. Mr. Tobias suggested that in such cases the meter be tested on the premises of the customer so that he may be satisfied as to the result. For testing meters, central stations which have no accepted and reliable testing apparatus may resort to the lamp hour test. If the test made upon the meter demonstrates that it is accurate and that the customer in question was not warranted in making complaint, the reason for his higher bill should be investigated. Mr. Tobias said that contrary to the common opinion of the public that meters generally ran fast, they generally were slow. Of electric meters tested by the New York Public Service Commission in March, 1910, 92.4 per cent fell within the limits of error, 5.8 per cent were slow and only 1.8 per cent were fast. The speaker recommended that whenever a customer wanted his meter inspected a charge of $1 should be made, providing the meter was found to be accurate. Regarding care of meters, Mr. Tobias said that most small central stations do not take the proper care of their instruments. He explained how minor troubles can easily be remedied and also explained how to care for commutator meters. Something which seems to be very much neglected by the average central station is the meter installed in the office. The speaker suggested that customers be explained the operation of a meter whenever he calls at the office, and also recommended that consumers be instructed in how to read the meter.

Austin Burt, of Waterloo, Ia., opened the discussion of this paper. He said that the central station he represented had had no trouble with meters. A meter man is employed, whose duty it is to inspect every meter at regular intervals. Mr. Burt said that nearly every complaint of high bills was attributed to the meter, but upon investigation only about three per cent were ever found inaccurate.

George S. Carson, of Iowa City, said that he thought it necessary for every central station to have a standard meter testing set with which all meters complained of could be tested on the customer's premises. He did not think a charge should be made for these tests.

Prof. A. H. Ford, of the Iowa State College, suggested that small central stations which could not afford a test meter should buy one jointly with other nearby central stations and alternate in using it.

Gus Lundgren, of Cherokee, said that the station he represents owns a test meter and all meters complained

of are tested in the presence of the customer. This method, he said, had given good satisfaction.

Under the heading of general discussion, J. P. Jones, of Cedar Falls, read a report of a record he compiled on tungsten street lighting. A card index is maintained and a complete record of each lamp kept.

Following this discussion, President Brownell called upon F. H. Stevens, of the Evans Almirall Company, Chicago, for a few remarks regarding district steam heating.

Mr. Stevens spoke briefly of the success of district steam heating and mentioned several successful installations. Regarding the insulation of the underground steam mains, he said that the log insulation has proven the most satisfactory. Regarding rates, he said that the only successful method of charging was on a meter basis, the same as electricity.

The session on Thursday morning was opened with a highly interesting address by J. U. Sammis, of Le Mars, entitled "Public Service Commissions."

Mr. Sammis said that a public service commission law should be passed by the Iowa legislature, as it has both a moral and business side to it. At present there are only three states which have a comprehensive public service commission, namely, New York, Massachusetts and Wisconsin.

In the past five years fifteen new railroad commissions have been created, according to Mr. Sammis, and these commissions are separated into three classes: first, the commissions with the power to revise rates; second, those with the power take the initiative and make rates; and third, those with no power and no influence in rate making.

Regarding the advantages of a law of this kind, Mr. Sammis was of the opinion that it would abolish discrimination, evil service and rebating. The subject of rebating was fully discussed and the evils of it emphasized.

Further advantages of a public service commission law would result in a uniformity in account keeping, placing each manager on an equal footing with every other manager, and it would also result in taking public utility concerns out of politics. The establishment of a public service commission would, according to the speaker, cause a revolution in business methods, would make investments in public utility concerns more attractive.

Mr. Sammis said when the fact is considered that municipality is one of the parties that aids in rate making, it should be decided without question to leave the matter in the hands of a non-partisan committee. Rates should be fixed by scientific commissions which would consider every phase of the subject before fixing them.

In fixing rates, Mr. Sammis said, five things should be considered. These were the amount of the investment in the concern, the physical value of the property, the cost of manufacture, the cost of distribution, and depreciation.

Regarding the question of franchises, Mr. Sammis said that the establishment of a public service commission would result in public utility companies being granted indeterminate franchises. He said that this condition certainly should exist, as every public utility corporation should be a monopoly so long as it followed the laws of the state, and the rules and regulations of the commission. Mr. Sammis said that the capital of these corporations should be protected and city councils should not be allowed to grant franchises to additional companies unless the commission found that such companies were necessary to the public, and that the capital invested in the existing company or companies would not be affected. He said competition of public utility companies should not be allowed.

Illustrating successful operations of public service commissions, Mr. Sammis said that during the first eighteen months of the commission in Wisconsin, over 1,600 complaints were filed and every one of them was settled without the necessity of litigation.

In closing, Mr. Sammis said the question was a great one and he urged members of the association to do their utmost in having passed a public service commission law.

Following this address, Harry G. Glass, of the Westinghouse Electric and Manufacturing Company, presented a paper entitled "Securing Off-The-Peak Load."

In developing off-peak load, the first problem the central-station man must solve is how to make rates that will attract this business and yet be profitable. Mr. Glass said, in the majority of instances this can best be done by centralizing the source of supply and using higher voltage transmission, in this way cutting down powerhouse cost and increasing transmission expense very little. Mr. Glass then explained how this was accomplished by a central station with which he was formerly connected, and explained the various methods in which this company secured off-peak business, and gave a list of the arguments used by power solicitors.

In going into a profitable load-factor-increasing campaign the first essential is service. Mr. Glass said that prospects should be held off until the company is prepared to give service which is at least more reliable than that they have been using in the past.

The second essential is the personnel of the organization from the coal heaver up. They should have the spirit that they are working for a company which has a good thing to sell. Solicitors should be picked from men who believe in central-station power. Mr. Glass laid much stress on the character and ability of the solicitor.

The third essential is the policy of the company. Mr. Glass said that it was absolutely necessary to the success of any central station that is should be firmly impressed on the minds of all its representatives that it is efficiency rather than power that is being furnished, and that the customer be brought to see that the company is interested in the economical operation of his plant even though it does reduce the revenue derived from his installation temporarily.

In conclusion, Mr. Glass recommended that central stations train the members of their organization so that they may be in a position to be advanced as opportunity develops.

A brief discussion followed this paper, in which Prof. A. H. Ford, A. Burt and Mr. Glass entered. The latter explained the system of rates charged by the company with which he was formerly connected, which was a sliding scale proportional to the amount of energy consumed.

The closing session of the convention was opened with a talk on "Rates," by J. R. Cravath, of Chicago.

Mr. Cravath said that two things govern the fixing of rates, namely,

fixed charges and variable charges. The rate curve, he said, should closely follow the cost curve. Fixed charges should comprise insurance, taxes, interest and depreciation, and the variable charge should comprise the cost of manufacture, distribution, etc.

Mr. Cravath reviewed the rate discussion recently handed down by the public service corporations, reading abstracts of the decisions. He also explained the rates charged by several of the large central stations, laying particular stress on the rates of the Commonwealth Edison Company, Chicago, and the Minneapolis General Electric Company, Minneapolis, both of which charge a primary rate for a certain amount of current and a reduced secondary rate for all in excess of that amount.

In the discussion which followed, George S. Carson said that he believed public service commissions were almost a necessity, not only to insure fair treatment to the public but to assist the central stations in establishing a fair and profitable system of rates.

Austin Burt said that in many small central stations one man had the entire operation and business on his hands. He said that if a company could not afford to employ sufficient labor to carry out its business, it was not a paying proposition although it may be able to continue to operate on the "one-man basis" without loss, and in cases of this kind the rates were too low.

A. H. Ford said that another item enters in the fixed charge, in addition to those mentioned, namely, the customer's charge. This comprises reading meters, billing, etc., and in many cases it as high as $12 per customer per year.

E. A. Bullock, referring to the question of public service commissions, said that he believed it was not a question of how much a company could charge, but how much they should charge. He spoke of the commission bill which was defeated by the Nebraska legislature. Speaking of the items entering into the question of establishing rates, Mr. Bullock said that Mr. Sammis overlooked the fact that the cost of securing a customer was an important item.

J. T. Moffit, of Tipton, spoke of the abstract manner in which subjects were treated at the meetings and appealed to the members for concrete information on the subject of rates.

Austin Burt, replying, said that Mr. Moffit could secure the services of college graduates who would be glad to use their electrical knowledge for an opportunity of receiving practical experience.

President Brownell next read the report of the committee on investigation, inspection and testing of customers' installations. This committee reported that it had corresponded with a large number of central stations in all parts of the country and the replies indicated that while many companies are earnestly endeavoring to follow the rules laid down by the Board of Fire Underwriters, very few had comprehensive systems of inspection and testing.

THOMAS CRAWFORD,
President-elect of the Iowa Electrical Association.

Immediately following the reading of this report the association went into executive session and the concluding business taken up.

The report of the committee on facts and factors, the reading of which was deferred until the executive session, was read and adopted.

Upon vote of the Association the next annual convention will be held in Davenport.

The report of the nominating committee, which is given herewith, concluded the programme of the day. For president, Thomas Crawford, Clinton; vice-president, L. R. Crawford, Sioux City. W. N. Keiser was re-elected secretary, and W. A. Mall, Belle Plaine, treasurer.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION.

SEVENTH ANNUAL CONVENTION AT SIOUX CITY, APRIL 21, 22 AND 23.

The seventh annual convention of the Iowa Street and Interurban Railway Association was held Thursday, Friday and Saturday, April 21, 22 and 23. Headquarters were established in the West Hotel.

On account of many of the delegates desiring to hear the address of J. U. Sammis, delivered before the Electrical Association, no morning session was held on Thursday. The first session was, therefore, called to order by President P. P. Crafts promptly at 2 p. m. Thursday.

The address of the president was then begun. President Crafts said that many important events had happened since the last convention, chief of which was the adoption of the three-cent fare in Cleveland. He pointed to the fact that the public constantly demands better service, which necessitates better equipment and better tracks. The cost of supplies are also increasing; thus, he thought the three-cent fare unjust to the railways.

President Crafts gave his approbation to the campaign of public utilities to educate the public to recognize their problems and not to impose hardships on them. He said the confidence of investors in public utilities has been shaken by the way the public regards them and if conditions became worse there might be danger of developments coming to a standstill.

The prepayment car was discussed, and President Crafts spoke of it very favorably. He mentioned the paper to be read on the subject as well as other papers scheduled to be presented.

Following this address the reports of the secretary, treasurer and the various outstanding committees were read and adopted.

The first paper presented was one entitled "The Medical Side of the Claim Department," by Dr. A. J. McLaughlin, of Sioux City.

This paper dealt with the physical and mental condition of the employes of a railway as being the only way to minimize accidents. Dr. McLaughlin said that as profits increase, railways should pay better wages and then de-

mand better employes, particularly motormen, for with them the great problem rests.

He said that the motorman should be a healthy, sensible man with good eyes and ears and well developed muscles. He should be normal in every way, perfect mentally, morally and physically. Dr. McLaughlin said that it is important for the motorman to have a good heart, as a sudden shock might prevent him from doing his duty in time of accident.

In concluding, the speaker urged the railways to use the testimony of eye witnesses rather than employes in cases of accident, as the latter sometimes think of their positions when they are at fault.

The next paper presented was one dealing with track and overhead construction in street railway work, by Wm. A. Heindle.

The meeting was opened with the Interurban aspect of "Track and Overhead Construction," this side of the question being presented by F. J. Hanlon, of Mason City. This paper dealt with construction problems to be met with in interurban work.

The next paper presented was entitled "Why City Fares Should Not Be Lowered," by L. D. Mathes, of Dubuque.

Mr. Mathes treated upon the problem of securing an adequate revenue from passenger fares as one of the most serious now confronting the railway industry. He said that street railway fares being regulated, as a rule, by municipal or other law, must remain stationary, although the cost of producing the commodity which is exchanged for the fare is greatly increased.

Mr. Mathes said that the public often advances the argument that with the adoption of larger and heavier cars which are capable of a greater average speed, the railways increase their carrying and consequently their earning capacity. Against this theory the railways have the constant factor of obsolescence to meet.

He said that even though there might not be a constant demand on the part of the public for lower fares, there was always a demand for an extension of the transfer system, or that the railways pave streets, that they run an all-night schedule, even though it mean a loss and that in some cases a percentage of the gross receipts be given the city.

Summarizing, Mr. Mathes said that street railway fares should not be lowered for the following reasons: first, the five-cent piece in the hands of the purchaser assumes a greater purchasing power through the longer rides and superior rides provided by the company; second, the five-cent piece in the hands of the railway has a constantly less purchasing power, owing to increased prices of supplies; third, the demands of the municipalities involving assumption by the companies of increased burden in the way of taxes, expansion of transfer system, etc., and fourth, the attitude of the public in advocating short term franchises.

The afternoon session on Friday was again held in the convention hall of the West Hotel. The first paper presented was entitled "Why Interurban Fares Should Not Be Reduced," by H. W. Garner, of Oskaloosa.

Mr. Garner said that when the interurban was first introduced it was as a competing line to a steam road's suburban service. The rolling stock and track was light and the tracks generally laid along the highways.

However, conditions are no longer like that. The modern interurban has no excuse to offer for poor service. The equipment, rolling stock and track are now on an equal footing with the railroads. It is necessary for interurbans to have their track heavy and well ballasted and have their rolling stock on a par with steam roads. Also, interurban lines give more frequent service, make equally as good time and carry their passengers, generally, into the business district of a city. Mr. Garner therefore held that interurban fares should be, at least, the same as steam railroad fares.

A paper entitled "Depreciation,"

GROUP AT THE IOWA CONVENTIONS, SIOUX CITY, IA., APRIL 22.

This paper discussed in detail, rails, joints, tie rods and braced tie plates, spikes, bonds, ties, paving, drainage, and track work. Mr. Heindle said he took his data from the construction of railways in Davenport, Rock Island and Moline, so that the information given out compared as nearly as possible with Iowa conditions.

He said that the selection of the type of rail was more or less limited by the city officials, but a seven-inch rail is ample for all ordinary conditions. He recommended the use of steel ties on all track with concrete foundations.

The session on Friday morning was held at the Auditorium, thus giving the members opportunity to inspect the electrical exhibits of the manufacturers.

was next read by H. E. Weeks, of Davenport. Mr. Weeks said that this subject was uppermost in the minds of street railway men and that the time has come when it is necessary to acquaint the public with the actual conditions which confront the industry.

He treated the subject under two heads: abandonment on account of age, and that due to wear and tear. Mr. Weeks collected data from various public service commissions which he presented, together with the methods several large roads use in properly caring for depreciation. The common practice was found to be to deduct an amount equal to the estimated loss.

In the discussion which followed several delegates cited the method in which they handled the subject. A question was raised as to whether the depreciation fund should be set aside and not used or whether it should be invested in extensions.

Following this discussion a paper entitled "The Prepayment Car and Its Advantages," was read by A. J. Varrellman, of New York city.

This paper reviewed the history of the prepayment car and mentioned cities where they are being successfully used. Regarding advantages it was said that rear platform accidents are greatly lessened, and while conductors can still hold out fares, receipts have been greatly increased. Also, these cars necessitate less work on the part of the conductor and better men can be obtained.

Saturday's meetings were devoted to an executive session at which unfinished business was taken up. The meeting adjourned upon electing the following officers for the ensuing year: L. D. Mathes, Dubuque, president; J. F. Porter, Davenport, vice-president, and George M. McCartney, Des Moines, secretary-treasurer.

ENTERTAINMENT.

On Wednesday evening the members and guests of both associations were the guests of the exhibitors at a smoker given in the Banquet Hall of the Mondamin Hotel.

Several informal talks were made, songs were sung, and the affair voted an overwhelming success.

Immediately following the last session of the Electrical Association on Thursday, the members and guests were taken for a sight-seeing trip in automobiles furnished by the city. In the evening members and guests of both associations attended a local theatre as the guests of the Sioux City Traction Company, Sioux City Gas and Electric Company, and the Sioux City Service Company.

The theatre party was followed by a Rejuvenation of the Sons of Jove at the Elks' Club, at which a class of thirty-one were initiated. Following this a Joviation was held in the Banquet Hall of the Mondamin Hotel, Frank J. Hanlon, statesman for Iowa, acted as toastmaster.

Iowa Electrical Show.

The annual electric show conducted under the joint auspices of the manufacturers and supply men of the Iowa Electrical and Street and Interurban Railway Associations was held in the Auditorium, April 20 to 23. In point of arrangement of the booths and the extent of the displays made by many of the companies represented, the show closely followed the lines of those held in larger cities.

Wednesday evening the hall was opened to the public and the manner in which they took advantage of this opportunity of viewing the latest advances in the electrical industry would indicate that similar exhibitions would be held frequently.

The following is a fairly complete list of exhibitors, together with brief descriptions of their exhibits:

American Steel and Wire Company had on exhibition a complete line of rail bonds, a number of sample boards showing their application; bonding tools, telephone and telegraph rubber covered wires and cables and several stretches of right-of-way fence. The company was represented by Major Halloway, G. E. G. Quigley and B. H. Ryder.

Julius Andrae & Sons Company, Milwaukee, Wis., had on exhibition a line of Holophane reflectors; American electric irons and heating devices; Robbins and Myers fans; Elmo electric washing machines; Duncan and Westinghouse meters; Bryan-Marsh Mazda lamps; and a line of tungsten street lighting fixtures. Otto Borchert represented the company.

Bryan-Marsh Company, Chicago, Ill., exhibited in the booth of Julius Andrae & Sons Company a complete line of its Mazda lamps. Sam Furst was in attendance.

Central Electric Company, Chicago, Ill., exhibited a full line of Pittsburg porcelain insulators; high-tension wall switches and wall tubes; Columbia incandescent lamps; D & W fuses; Pittsburg Transformer Company's transformers; Pelouze electric irons; C. E. Company's time switches; Westinghouse and Duncan meters; high-tension span dropouts; "Banner Brand" weatherproof copper wires; Shedd series cutouts and meter connecting blocks; Opalux shades; tungstometers; tungstolites; Galvaduct and Loricated conduit and a complete line of Okonite wires and cables and Okonite and Manson tape. The company was represented by F. B. Switzer, F. P. Kennedy and B. J. Kacin.

Duncan Electric Manufacturing Company, Lafayette, Ind., had on exhibition a complete line of its integrating wattmeters. Several of the meters were dissembled to permit closer inspection of the various parts. A feature of this exhibit was a Duncan rotating standard watthour test meter. Adrian Tobias was in charge, assisted by M. E. Mozingo.

Electric Appliance Company, Chicago, Ill., had on exhibition a complete line of Packard transformers; Adams Bagnall flaming arc lamps, Emerson fans, and a full line of electrical specialties. F. J. Alderson, J. K. and C. F. Alline were in attendance.

Fort Wayne Electric Works, Ft. Wayne, Ind., exhibited a number of power transformers of various sizes; a full line of small motors, several types of electric meters and the new Ft. Wayne compensarc. The company was represented by A. L. Pond, A. P. Dunn and M. A. Buehler.

Grinnell Washing Machine Company, Grinnell, Ia., had on exhibition several of its well-known Elmo electric washing machines. M. A. Ayer was in attendance.

General Electric Company had on exhibition a number of arc lamps, including the twenty-hour flaming arcs, the intensified arc, and the luminous magnetite arc; Mazda economy diffusers; a complete line of heating and cooking appliances, including flat irons, chafing dishes, toasters, percolaters, flat unit stoves, cigar lighters, combination cereal cookers, hot-water heaters and the new six slice radiant toaster. The exhibit also included soldering irons, washing machine motors, sewing machine motors, alternating and direct-current drills; a line of meters, including the the new prepayment meter; series and multiple arc lamp cutouts; a complete line of fans, including the new eight inch induction, three speed fan; and moving picture and bell ringing transformers. At one end of the exhibit was a combination board equipped with two alternating-current meters, one measuring the current consumption of a thirty-two candlepower Mazda and the other of a thirty-two candlepower carbon lamp. Wm. Kahl, J. D. A. Cross, Fred Benson, O. P. Jenks, J. Van Splunter, Louis Friedman, J. Numan and Frank Murphy were in attendance.

W. R. Garton Company, Chicago, Ill., had on exhibition a base-board equipped with trolley, bayonet, quick-attachment trolley head, in conjunction with Earle retrievers. There was also shown a line of Lord Electric Company's soldered rail bonds, nonarcing lightning arresters, hydrogrounds, etc; Waterbury wires and cables; Heany fireproof wires; Universal car steps and a full line of railway material and supplies. The company was represented by E. Lewis.

Hobart Electric Manufacturing Company, DesMoines, Ia., exhibited a number of motor-driven coffee grinders, meat choppers and bone grinders. J. E. Williams was in attendance.

Holophane Company, Newark, Ohio, had on exhibition in the booth of Julius Andrae & Sons Company, a line of Holophane glass and steel reflectors. The company was represented by M. P. Ellis.

The Hensley Trolley Company, Detroit, Mich., showed a line of trolley wheels, spindles and miscellaneous railway supplies and materials. John Hensley represented the company at the show.

Illinois Electric Company, Chicago, Ill., showed a complete line of lighting and heating devices, window whirlers, sign flashers, electric drills, small motors and lighting arresters. There was also shown a line of Chicago Fuse Wire and Manufacturing Company's goods, Peerless Electric Company's fans, and American Electric Heater Company's flat irons and accessories. The company was represented by L. K. Cushing and J. A. Duncan.

The Imperial Manufacturing Company, In-

dependence, Kans., showed several of its combined electric washing machines and wringers, which were demonstrated in operation. The company was represented by Fred Owen of Independence, Kans.

The Interstate Supply Company, Sioux City, Iowa, exhibited Benjamin lighting specialties and wireless clusters, a full line of Brilliant incandescent lamps, sample board of National Metal Moulding Company's material, Holophane reflectors, Diehl motors and fans, Westinghouse lighting arresters, American Electric Heater Company's irons, a line of Arrow Electric Company's specialties, Interstate switchboard equipment, Bissell sewing machine motors, Matthews' specialties, and miscellaneous line of electrical goods. The company was represented by B. H. Chase, A. R. Pearsons, L. F. Payne, F. D. Smith, J. Hemnes and M. McGraw, president of the company.

The Indianapolis Brass Company exhibited a line of trolley material and other of its products in the booth of the Hensley Trolley Company. L. L. Honstein was in attendance.

W. N. Matthews & Brother, St. Louis, Mo., had on exhibition in the booth of the Interstate Supply Company a full line of Matthews specialties, including guy anchors, hold-fast lamp guards, cable splicing joints, cable rollers, easy cord adjusters, lamp changers, etc. Victor Crawford was in at tendance.

Milwaukee Vacuum Cleaner Company, Milwaukee, Wis., exhibited several of its electrical vacuum cleaning machines, together with a full line of cleaner tools.

The McDonnell Iron Works, DesMoines, Iowa, had installed at each corner of the Auditorium an Imperial type, five globe standard for street lighting. Enclosed in each globe was a forty-watt tungsten lamp. Preston Daniels represented the company.

The Iowa Electrical and Manufacturing Company, Waterloo, Ia., had on exhibition a complete line of Philadelphia Electrical and Manufacturing Company's tungsten street lighting specialties, together with street lighting fixtures of its own manufacture. The company was represented by Ray H. Manwaring.

The Monarch Electric and Wire Company, Chicago, Ill., had on exhibiton a full line of its wires; Monarch lamps, Bryan-Marsh lamps, Tuerk fans, and a complete assortment of miscellaneous supplies. The company was represented by H. E. Mason.

Ohio Brass Company, Mansfield, Ohio, had on exhibition overhead trolley material; porcelain insulators; rail bonds; Tomlinson couplers; sander valves and O. B. car signal systems. The company was represented by Robert J. Deneen and E. C. Brown.

Rail Joint Company, Chicago, Ill., had on exhibition a number of sample rail joints and fittings. The company was represented by F. M. Hull, manager of the company.

Sangamo Electric Company, Springfield, Ill., exhibited a full line of electric meters, including switchboard and service types and amperehour meters, for both alternating and direct current. There was also shown a Sangamo rotating standard test meter. R. C. Lanthier was in attendance.

Wagner Electric Manufacturing Company, St. Louis, Mo., had on exhibition a full line of single-phase and polyphase motors, and a complete assortment of measuring instruments. The company was represented by N. W. Briscoe.

The Western Electric Company had on exhibiton a standard line of Hawthorn motors, transformers, both bell-ringing and lighting; fans and starting rheostats. There was also shown a line of American Heating Company's heating and cooking devices, Western Electric intercommunicating telephone sets, arc lamps and flaming arc lamps. In an adjoining booth the Electric Supply Company, Sioux City, representatives of the Western Electric Company, had on exhibition a number of electroliers and lamps. W. P. Hogan, J. H. Gleason, C. T. Goldin and C. C. Dawson represented the Western Electric Company, and George May the Electric Supply Company.

The Western Valve Company, Chicago, had on exhibition a full line of valves, fittings and specialties. The company was represented by Q. T. Stewart.

The Westinghouse Electric and Manufacturing Company had on exhibition a very complete line of its smaller pieces of apparatus for practically all kinds of work. Its industrial and power apparatus consisted of nine or ten different types of motors for both alternating and direct current, with the controlling pieces of apparatus for the control of the different motors when used on different classes of work. Among the railway pieces of apparatus which this company showed was a complete line of its overhead trolley line material, consisting of different types of hangers, cross overs, switches, and several types of wood and composition strain insulators. Among the pieces of electrical apparatus for use in the home which this company had on exhibition were several sizes of electric sad irons; toaster stoves, disc stoves, percolators, sewing machine motors, bell-ringing transformers, electric heaters and air heatrs.

The Westinghouse Lamp Company had for its part of the exhibit a very complete representation of different types and sizes of low-voltage tungsten lamps, which were in operation on a 110-volt circuit, with one of its economy coils. It also showed a very complete display of 110 and 220-volt tungsten lamps in operation, as well as the lay exhibit of incandescent lamps for practically all classes of service, including street series lighting, railway work and general illumination. Among those in attendance were the following representatives: A. M. Miller, W. R. Pinckard, H. L. Garbutt, E. W. Bischoff, C. R. Wood, H. H. Coughlan, S. G. Peteicolas, C. W. Regester, F. W. Parkinson, of Chicago; J. B. Wilkinson, Westinghouse Machine Company, Chicago, Ill.; H. G. Glass, Pittsburg; W. Barnes, Jr., representing the Westinghouse Bureau of Publicity, of Pittsburg, in charge of the exhibit.

Among those present who did not maintain exhibits, were the following:

C. W. Wilkins, National Carbon Company, Cleveland, Ohio; H. W. Power, White City Manufacturing Company, Davenport, Ia.; C. T. Clark, National Lead Company, St. Louis, Mo.; J. B. Mendenhall, National Lead Company, St. Louis, Mo.; E. E. Brando, National Lead Company, St. Louis, Mo.; W. J. McFadden, Sterling Lamp Company, Sioux City, Ia.; Glen Deyo, of J. R. Lehnier, Omaha, Neb.; F. H. Stevens, Evans Almerall Company, Chicago, Ill.; L. J. Bridger, Northwestern Electric Company, St. Paul, Minn.; A. J. Varrelmann, New York; Fred W. Brill, American Car Company, St. Louis, Mo.; D. F. Linneen, Diehl Manufacturing Company, Chicago, Ill.; C. W. Rhoades, St. Louis Surface and Paint Company, St. Louis, Mo.; W. G. Atkins, American Electric Works, Chicago, Ill.; J. D. Zook, Gregory Electric Company, Chicago, Ill.; L. S. Hunt, Comercial Electric Supply Co., St. Louis, Mo.; R. H. Rawson, McMaster-Carr Supply Company, Chicago, Ill.; A. A. Jeffrey, Terry & Company, Cedar Rapids, Ia.; L. A. Heitmeier, Wesco Supply Company, St. Louis, Mo.; M. J. Perrin, Waterloo Electric Supply Company, Waterloo, Ia.; M. P. Ellis, Holophane Electric Company, Newark, Ohio; Chas. D. Stanton, Johnston Electric Company, Omaha, Neb.; E. C. Kurman, Beardslee Chandelier Manufacturing Company, Chicago, Ill.; J. U. Everett, Columbia Lamp Company, St. Louis, Mo.; F. O. Grayson, St. Louis Car Wheel Company, St. Louis, Mo.; L. G. Mockenhampt, Harvey Hubbell, Inc., Bridgeport, Conn.; H. P. Woodruff, Sterling Lamp Company, Sioux City, Ia.; E. H. Hammond, American Electrical Works, Chicago, Ill.; H. J. Ryan, Fogg & Ryan, Sioux City, Ia.; W. F. Carr, The Falk Company, Milwaukee, Wis.; H. L. Ogg, Automatic Electric Washer Co., Newton, Ia.; W. R. Collins, New York and Ohio Company, Warren, Ohio; E. Lavis, Roake Register Company, Providence, R. I.; E. L. Barnes, American District Steam Company, Chicago; H. P. Ryner, Hoescher Manufacturing Company, Omaha, Neb.; G. M. Huber, Atlas Railway Supply Company, Chicago, Ill.; R. E. Green, Standard Underground Cable Company, Chicago, Ill.; H. C. Berhoup, McConway & Torley Company, Company, Pittsburg, Pa.; E. R. Stubbs, Viscosity Oil Company, Chicago, Ill.; F. C. Gibbs, Dearborn Drug and Chemical Works, Chicago, Ill.; C. H. Dodge, Taylor Electric Truck Company, Troy, N. Y.; F. H. Welling, Federal Electric Company, Chicago, Ill.; C. E. Schaffler, Galena Signal Oil Company, Chicago, Ill.; W. S. Hammond, Consolidated Car Heating Company, Chicago, Ill.; E. C. Folsem, The Railway Materials Company, Chicago, Ill.; Drew Allen, Pennsylvania Steel Company, Chicago, Ill.; J. F. Hennessy, Pennsylvania Steel Company, Chicago, Ill.; W. E. Himson, Cooper Heater Company, Dayton, Ohio; A. E. Williams, National Electric Lamp Association, Cleveland, Ohio; H. W. Neal, of J. R. Lehmer, Omaha, Neb.; Frank Wolcott, Marshall Oil Company, Lincoln; H. C. Downing, Downing Electric Company, Des Moines, Ia.; Wm. C. Wing, Brilliant Electric Company, Cleveland, Ohio; H. E. Watson, Benjamin Electric Manufacturing Company, Chicago, Ill.

Pacific Coast Electrical Exposition.

At a meeting in San Francisco on April 15 last of the exhibitors of the Pacific Coast Electrical Exposition, it was decided to hold the exposition at the Coliseum, San Francisco, between August 15 and September 15, 1910. The exposition will be on quite a large scale and all contracts previously made with exhibitors will stand under the change made in the arrangements.

The delay is due to the fact that the Coliseum Building will not be ready for occupancy until the dates announced above, no other building of a size compatible with the importance of the show being available. Exhibitors are being informed by circular of the above resolution.

Electric Drive in Machine Shops.

At a combined meeting of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, in New York on April 12 last, four papers on the subject of electric drive in machine shops were read and discussed. An abstract of one or more of these papers will be given in an early issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

Ohio Telephone Bill Lost.

The Elson telephone merger bill was defeated in the Ohio senate recently by a vote of fourteen to nineteen. The bill has, since its introduction, been the subject of much controversy.

Chicago Electric Club.

At the regular luncheon and meeting of the Chicago Electric Club on Wednesday, April 20, Frederick Darlington of Pittsburg, electric engineer, Westinghouse Electric and Manufacturing Company, delivered an able address on the problem of railroad electrification. Mr. Darlington said that it was not possible in the time at his disposal to more than point out some of the leading features which enter into the determination of costs and the reasons for steam-road electrification.

He discussed particularly the subject of the transmission of power from the power house and its distribution to moving trains. This phase of the subject, Mr. Darlington asserted, was of the greatest importance in that it held the solution of the problem of steam-road electrification. Were it possible to deliver the power to the moving train without the intermediate costly transmission apparatus, with its accompanying energy losses, electrification would be without doubt a very ready choice. It was in the transmission system, however, that the greatest variation of costs might occur, and the choice of a system must necessarily be based upon the most available method of transmitting the energy to the moving trains.

Continuing, Mr. Darlington said in part:

The economical, geographical, sociological and political considerations involved in the problem have fully as much or perhaps more to do with the case than the mechanical and electrical features. The dollar is the first and final measure by which the application of electrical power to railroads will be judged, and the cost of electric operation and the effect on earnings combined determine where and how it will be used. The cost of the work and the returns therefrom, whether the returns are direct or indirect, will determine the manner and place of railway electrification, and, involved in the matter are innumerable details of calculation, of judgment, of expediency, of methods of operation, of adaptability to conditions, etc., but all of these only enter into the problem as they affect the final success measured by the money earning power of railroads.

In short, will electric operations increase earnings?

Railroading has become so complex that engineers who are concentrating their efforts to develop specific pieces of machinery are liable to center their attention on some particular machine or appliance and lose sight of the involved financial and operating conditions that belong more especially to railroad operating and traffic departments, than to engineering.

There are three distinct electric railroad systems: the direct current system; the single-phase, alternating current system; the three-phase alternating current system.

Any one of these systems can be used to move trains; each of them is in practical operation, and no doubt further applications of each system will be made as new conditions arise in the future, but the distinctive characteristics of the three systems are now well enough understood to determine which should be used, based on their cost and earning power, for every case that arises, and in view of this knowledge and past experience the majority of railroad electrification problems should not be questions between the relative merits of this or that electric system or piece of apparatus, but questions of the advisability or otherwise, of making the necessary investment to install whichever one of the recognized successful electric railroad systems is most advisable.

Although in the light of present engineering knowledge it is generally easy to determine which system is best to use in any particular case, a more difficult question is, where, and in what way, will electric railroading pay? A choice between electric railroad systems should be made after examination of the electrical equipment and operating costs for the railroad under consideration, always with due regard to future growth of business and extensions of the electrified zone and interchangeability with present and future electrically operated roads, and except in unusual cases, the choice can be surely narrowed down to one system.

Examination of the different systems shows that in each there are three essential parts:

An electric power generating plant.

Apparatus for transmitting electric power from the generating plant and distributing it to moving trains.

Electric locomotives and car equipments.

It is in the second of these items that includes the transmission lines, sub-stations and trolleys or third rails that there is the greatest difference between the three systems in the cost of construction and in the convenience and economy of operation; and the difference is most apparent when the electrical equipment is for moving heavy trains long distances, as on steam railroads, instead of single cars or light trains as on trolley roads.

Any one of the three electric railroad systems would find rapid and extensive application on steam railroads if it was not for the heavy cost and inconvenience of the apparatus for transmitting and distributing electric power from the power plant to moving trains. If the electric power could be delivered from the power house to the trains without trolleys or third rails and other apparatus, steam locomotives would soon be a thing of the past, just as small stationary steam engines are fast giving place to electric motors in factories and workshops. For ordinary steam railroad train weights and conditions of traffic, the transmission and distribution apparatus is the most costly and troublesome part of railroad electrification, and it is mainly because of this cost and trouble that electric power is not in general use on nearly all of our heavy railroad trains.

How far can the cost and difficulty of distributing electric power to trains be overcome by improvements in electrical apparatus? Much has been done in this direction by the development of alternating current railroad systems, and, as just stated, the advantage secured is more marked where heavy trains are to be moved long distances than for light trains or short distances.

C. E. Eveleth, in a paper recently presented in Philadelphia, gives the latest published figures on 1,200-volt, direct-current railroad electrification, but unfortunately the heaviest equipment upon which he gives costs is for handling three forty-six and one-half-ton cars per train, and he further makes the assumption, as the basis for his figures, that the trains are distributed at fairly equal intervals, and operated on uniform headways as in interurban trolley service, and does not provide for several trains being near together, or double-headed, etc. He gives the cost of electric power transmission and distribution apparatus, including sub-stations, for operating three-car trains on one hundred miles of railroad, with 1,200 volts direct-current on a third rail, $1,346,000, or $13,460 per mile. This is a high cost for power transmission and distribution apparatus, and is much greater than the cost of the cars and electrical equipments for the same railroad, and he still further shows a high cost of operation and a large loss of electric power between the power house and the trains. It is too bad that Mr. Eveleth did not give the cost of electric power transmission and distribution apparatus for trains of 300 or 500 or more tons each, and on a road where the trains are unevenly distributed as to headway and position, for such are the general conditions on steam railroads for which we want economical motive power apparatus. To a certain extent at least this purpose has been attained by the development of alternating current electric railroad systems. The simplest electric railroad power transmission and distribution apparatus is for the so-called single-phase alternating current system.

For single-track railroads where the power per train is 1,000 to 1,500 horsepower, and where the power concentrated within very short distances along the track may be 3,000 or 4,000 horsepower, the entire cost of single-phase transmission and distribution apparatus, including transformer stations, will generally be between $4,000 and $9,000 per mile, excepting on branches and spurs where the high tension trolley extends beyond the limits of the high tension transmission lines. In these places, where there is no high transmission line, the cost of the necessary trolley and track bonding will be only about $2,500 per mile. There is practically no operating labor required for the transformer stations as they only need occasional inspection, and the efficiency of the single-phase transmission and distribution system averages very high and the standby losses are nothing but stationary transformer leakages, which are small.

There are not nearly so many mechanical objections to the single-phase distribution system from a railroad operating point of view as there are to the other electric railroad distribution systems. The overhead structure should be placed high enough to clear the heads of trainmen when standing on the highest cars and the structure should be sufficiently strong to reduce the danger of falling wires to a minimum. The standard designs generally in use practically accomplish this, as the contact wires are held in suspension high above the tracks by heavy steel messenger cables.

Some care has to be used where the high-tension trolleys are carried under low bridges or through tunnels, but these troubles have been met successfully. The single-phase distribution system with the single-phase catenary trolley is suitable for all places and requirements where steam railroad trains can be operated, and where ordinances or regulations based on aesthetic grounds do not prohibit the erection of overhead trolley conductors, and where life or property will not be jeopardized by high-tension wires securely erected twenty-two feet above railroad tracks. It is obvious that wherever railroads can run it is possible to erect a single wire over the tracks, and the single wire can be made to follow over any network of tracks, sidings, turnouts, or branches. Much has been said about the necessity of rearranging railroad terminal tracks, etc., to provide for the substitution of electric power for steam, but granting the right to use overhead conductors there is no reason why the substitution

of electric power for steam power should necessitate track changes, and there are no train movements made by steam locomotives that could not be made on the same tracks with electric power. This applies alike to main line work and to switching and making up trains on side tracks and in terminal yards. In short, electric locomotives can be satisfactorily operated wherever steam can be, and in some places and under some conditions where steam railroads would not be satisfactory.

In many estimates for the electrification of railroads, the proposed cost largely exceeds the cost of the electrical appliances and equipment alone necessary to move existing traffic. This is often occasioned by including improvements and track changes that are not essential to the electrical operation of established trains, the purpose being to increase the facilities for handling traffic, and the cost of such changes should not be charged against electrical operation, without giving due credit for the other advantages secured.

Considering the great cost of the transmission and distribution appliance for the three electrical systems, it is clear that the best of the systems will be limited in their use by this cost. Even $5,000 per mile is a very heavy charge to put upon a railroad and $5,000 is a fairly low cost for single-phase distribution apparatus, including a high-tension transmission line with transformer stations and a standard 11,000-volt single catenary trolley for operating heavy steam railroad trams; and excepting where the distances covered are very short, this makes up a large part of the total cost of railroad electrification. Other systems requiring a still greater cost for power transmission and distribution apparatus are necessarily under a greater handicap, especially if at the same time they sacrifice efficiency and require increased operating labor, and the use of such systems will ordinarily be limited to places or sections of track that are very short and therefore require relatively little distribution apparatus, or where the trains are light.

It may be objected to this line of argument that consideration is given wholly to the relative merits of the transmission and distribution systems and that no mention is made of the relative merits of the various types of motors, of locomotives, of power plants, etc. This is entirely true, but it is impossible to cover the whole subject in a short talk, and it is in the transmission and distribution of power that there is the greatest difference between the three systems, both in cost and efficiency, and furthermore, where the distances covered by electrification are considerable, and for the ordinary frequency of trains, or as it is called, the density of traffic, most frequently occurring in railroad work, the electric power transmission and distribution system is the largest element in the cost of electrification.

There is another matter that it would hardly be right not to bring up in this connection, for it is absolutely essential to any successful railroad motive power system and concerns the transmission and distribution apparatus as well as the power plant and the motive power on trains That is, reliability of service. All of the systems are surely reliable when properly installed and operated. Direct current motive power has proven its reliability by many years of use. Even the light and relatively poorly built apparatus of the interurban trolley roads installed several years ago is working along and giving good reliability in most cases. The New York Central terminal service by direct current is reliable, and the direct-current apparatus on the West Jersey and Seashore, and on the Long Island Railroad, and on the various elevated and subway roads of our cities is performing reliably. That single-phase railroad apparatus is highly reliable is proven by the successful operation of over forty-five single-phase electric railroad systems in America and Europe. On the single-phase system of the New Haven Railroad, between New York and Stamford, during ten months ending April 1, 1910, the locomotive mileage averaged per locomotive delay from both mechanical and electrical causes was 12,275 miles. This is two or three times better than steam locomotives average in the same kind of work.

For the month of March on the same system with over forty electric locomotives in operation, there were only fourteen motive power delays, including delays due to the power plant, the transmission and trolley lines, and the locomotives, and part of these fourteen delays were due to causes that were not electrical, such as derailment and failure of air brakes, etc.

I cannot give data on the reliability of three-phase electric motive power from results of operation, but three-phase motors are reliable and it is not likely to be charged against three phase locomotives that they will not operate reliably, provided the two separately insulated trolley wires necessary for three-phase current do not prove too troublesome.

Battery Capacities.

In the article entitled "Chicago Electric Club" which appeared on page 787 of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of April 16 some errors were made in stating the battery capacities used by different companies.

The eighth line of the second paragraph of this article should read 23,000 instead of 27,000. In the same paragraph the 57,000 kilowatts should refer to the total kilowatt capacity of batteries installed in New York city for all purposes. The New York Edison Company has not 57,000 kilowatts.

In the fourth paragraph, the figure should be 1,200 instead of 12,000 and two lines below, the figure 24,000 should be 2,400.

The first sentence in paragraph eight should read, "The battery in this case was connected directly across the direct-current terminals of a rotary-converter without any booster in the battery circuit." The next sentence should read, "On the same shaft with the rotary was placed," etc.

Marconi Wireless Stock Reduced.

After the annual meeting of the Marconi Wireless Telegraph Company in Jersey City, N. J., at which there was some protest against decreasing, the capital stock of the company from $6,500,000 to $1,625,000, a special meeting was held, at which the reduction was made by a vote of 40,020 shares against sixty-four. The curtailment was effected by the reduction of the par value of the present stock from $100 to $25.

John Bottomley, vice-president, general manager and secretary of the company, explained that the capital reduction would have the immediate effect of reducing taxation in a number of states where the company is compelled to pay taxes on its capitalization.

Mr. Bottomley read a statement saying the company had had a better year in 1909 than ever before. The receipts last year exceeded those of 1908 by $25,000. He said that it was the first year in the company's history that it had done a little better than to be self-sustaining. Profits of about $18,000 had been earned, he said, out of which $15,000 had been charged off for depreciation, leaving about $3,700 net.

United Railway Investment Bonds.

At the annual meeting of the United Railways Investment Company, of San Francisco, to be held on May 6, stockholders will be asked to authorize an issue of $6,000,000 twenty-year six per cent convertible bonds, convertible into common stock at par from and after a date yet to be fixed by the board of directors. Authority will also be asked to increase the common stock by $6,000,000 for the purpose of converting the bonds.

The proceeds of the proposed bond issue by the United Railways Investment Company will be used for refunding $2,900,000 serial six per cent notes outstanding, $1,400,000 scrip, issued in payment of dividends, and about $800,000 other indebtedness. This will leave a balance of approximately $900,000, which will be available to the company for other corporate purposes. The new bonds are subject to redemption at the option of the company at 105 and interest upon sixty days' notice on any interest date.

Safety Device for Car Doors in New York Subway.

An automatic device to make the side doors of cars safe is to be installed in all trains in the New York city subway. The doors will be so arranged that they will fly open to their full width upon coming in contact with any object, so that passengers need have no fear of being caught and carried with the train.

COPPER—ITS PRODUCTION AND PRICE IN 1909, AND THE PRESENT OUTLOOK.

BY JOHN B. C. KERSHAW.

The large amount of copper used by electrical engineering firms and the rumors that have been lately circulated on both sides of the Atlantic concerning a reduction in output and rise in price during the present year, render the study of last year's figures for the price and production of copper of considerable interest and importance.

PRODUCTION IN 1909.

The output of raw copper in 1909, according to the figures compiled by the publishers of *The Engineering and Mining Journal*, of New York, and by A. R. Merton and Company, of London, and published in the *Annual Statistical Circular*, was 839,255 tons, an increase of 84,945 tons over the previous year's total of 754,310 tons. This increase of 84,945 tons is the largest tonnage increase yet recorded in the annals of the copper mining industry, and represents a gain of 11.2 per cent on the previous year's output.

Table I shows the aggregate output of all copper mining countries for the past ten years, with the percentage annual increase:

TABLE I.

Year.	Aggregate Production in Long Tons.	Increase.	Percentage Increase.
1900	479,514	7,270	1.5
1901	516,628	37,114	7.7
1902	541,295	24,667	4.7
1903	574,775	33,480	6.1
1904	644,000	69,225	12.0
1905	682,125	38,125	5.9
1906	714,100	31,975	4.6
1907	713,865	235*	0.03*
1908	754,310	40,445	5.7
1909	839,255	84,945	11.2

*Decrease.

The copper production of the world has in fact doubled during the past twelve years, for in 1897 the aggregate output of all countries only amounted to 399,730 tons. The enormous increase of the past year is chiefly due to the larger output of the mines in America, Africa and Mexico, Table II showing the relative gains and losses, in long tons, of the leading copper-mining countries.

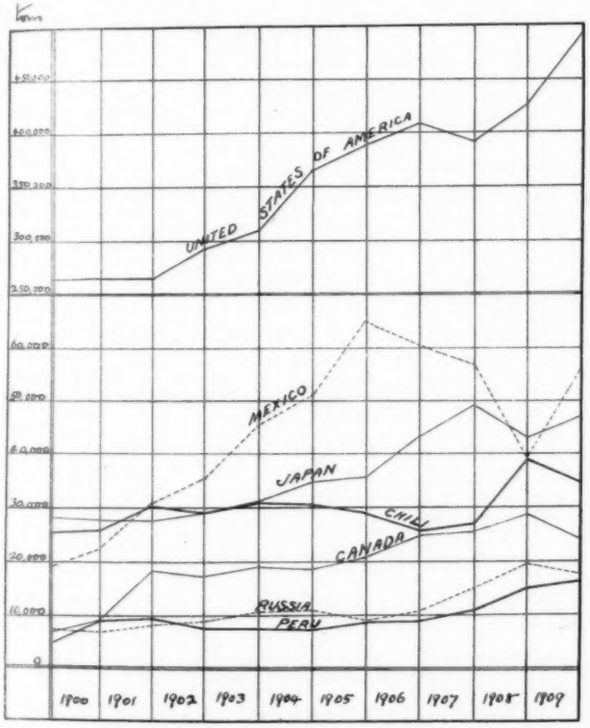


FIG. 1.—PRODUCTION STATISTICS OF COPPER, 1900-1909.

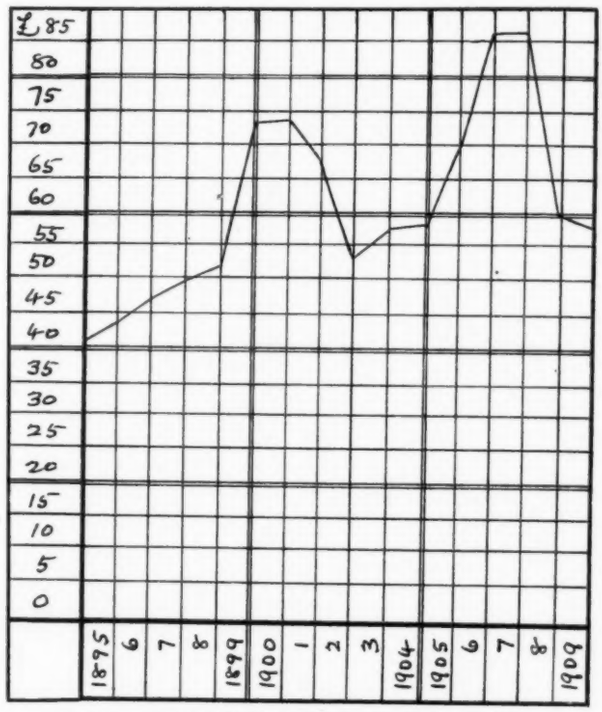


FIG. 2.—PRICE VARIATION OF COPPER, 1895-1909.

TABLE II.

	1908.	1909.	Gain.	Loss.
United States	423,300	590,310	67,010	.....
Mexico	39,990	56,240	16,250	.....
Spain and Portugal	52,585	52,185	.....	400
Japan	43,000	47,000	4,000	.....
Chili	38,315	35,785	.....	2,530
Australasia	39,500	34,400	.....	5,100
Canada	28,570	24,105	.....	4,465
Germany	20,200	22,455	2,255	.....
Russia	20,085	17,750	.....	2,335
Peru	15,000	16,000	1,000	.....
Africa	6,880	14,945	8,065	.....
Norway	9,190	9,080	.....	110
Hungary	2,240	4,505	2,265	.....
Remaining countr's	15,435	14,495	.....	960
Total	754,310	839,255	100,845	15,900

Net gain, 84,945 tons.

The most notable increases in Table II have already been referred to, and it is of interest to analyze the production returns of the United States, Africa and Mexico still more closely, in order to see exactly which group of mines has been responsible for these large increases over the 1908 output.

In Table III are the figures (in long tons) given in H. R. Merton and Company's last circular.

TABLE III.

United States Mines—	1908.	1909.	Increase
Calumet & Hecla	40,000	40,000	.....
Other Lake Mines	59,225	61,350	2,125
Montana	112,750	140,665	27,915
Arizona	129,540	129,945	405
Other States	81,785	118,350	36,565
Total			67,010
Mexican Mines—	1908.	1909.	
Boleo	12,400	12,230	170*
Other Mexican Mines	27,590	44,010	16,420
Total net increase			16,250

*Decrease.

African Mines—	1908.	1909.	
Cape Company	4,480	4,645	165
Namaqua	2,400	2,300	100*
Sundries	....	8,000	8,000
Net gain			8,065

*Decrease.

These figures show that it is the outside mines of the United States and of Africa and Mexico, that have been chiefly responsible for the increased production of 1909, these three groups of mines having a net gain of 60,880 tons to their credit, out of the total net gain of 84,945 tons. The most notable decreases in the production of 1909 have been those of the Canadian and Australasian mines. In the case of Australasia, the prolonged trouble in the coal-mining industry has been chiefly responsible for the diminished output of the copper mines.

The relative positions of the more important copper-mining countries as regards output of copper, for the period 1900-1909, are shown in diagrammatic form in Fig. 1. The comparatively steady progress of the United States mines and the fluctuation in the output of the mines of Mexico and Chili, are brought out clearly in the diagram. The production curves for Germany and for Spain and Portugal are not included since the annual copper production of these countries is maintained fairly steady at 20,000 and 50,000 tons respectively, and the fluctuations above or below these totals are small.

PRICE VARIATIONS IN 1909.

In an article on "Copper Production in 1908" in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of May 1, 1909, the writer stated his belief that copper would descend to a lower level of price before any recovery occurred. The record of the price of copper during the past year shows that this forecast has been correct.

The settlement prices of standard copper at the close of each month of the past year are given as follows by H. R. Merton and Company in their valuable statistical circular for March 31, 1910: December 31, 1908, £63-15-0 ($318.75); January 30, 1909, £58-10-0 ($292.50); February 27, 1909, £56-2-6 ($280.60); March 31, 1909, £57-0-0 ($285.00); April 30, 1909, £57-10-0 (287.50); May 30, 1909, £60-17-6 ($304.25); June 30, 1909, £58-17-6 ($294.25); July 31, 1909, £58-7-6 ($291.75); August 31, 1909, £59-15-0 ($298.75); September 30, 1909, £59-7-6 ($296.80); October 31, 1909, £57-12-6 ($288.00); November 30, 1909, £58-0-0 ($290.00); December 31, 1909, £61-15-0 ($308.75).

The range of price during the year has been remarkably small considering the fluctuations of previous years, the margin between the highest and lowest price recorded being only £9-12-6 ($48.00). The highest price touched was £64-2-6 ($320.60) on January 4, 1909. The year closed with standard bar copper selling at £2-0-0 ($10.00) per ton less than at its commencement, and the first three months of 1910 have witnessed a further decline in selling value, the settlement price for March 31, 1910, being £57-17-6 ($289.25).

The question of special interest for the electrical engineer is—Will this low level of prices continue throughout 1910 or is an increase in price and approach to the level of prices attained in the years 1907-1908 probable?

The curve in price variations shown in Fig. 2, covering the period 1895 to 1909, is of special interest in connection with this question, for it shows that the collapse in price which occurred in the year 1901 lasted for two years, and that a gradual improvement then set in, extending up to 1908, when another collapse in values occurred.

Now the curve of prices for the period 1895-1903 appears as though it would be repeated in the period 1903-1910.

It is, of course, not wise to press the similarity in the form and period of the price curves too far, especially in the case of a metal which is subject to so much market manipulation as copper. One may state, however, with some degree of confidence, that the conditions which affect the situation all point to a rise in the price of copper during the present year. The author therefore advises those who are likely to require large amounts of copper for fulfilling contracts and orders during the present year and early in 1911, to purchase for prompt and forward delivery at once, at the prices now ruling in the copper market, and not to adopt a waiting policy.

American Physical Society.

At the meeting of the American Physical Society held in Washington on April 22 and 23, several papers of interest to electrical engineers were read. Among them were: "Temperature Coefficient of Resistivity of Copper," by J. H. Dellinger; "The Reliability of Magnetic Measurements on Rods," by C. W. Burrows; "Some Investigations on Mica Condensers," by H. L. Curtis; "Inductance of a Metal Tube Bent into the Form of a Circular Ring," by F. W. Grover; "Mutual Induction of Coaxial Cylindrical Current Sheets," by G. R. Olshausen.

Mr. Curtis, in speaking of condensers, pointed out the difference found in measurements made with alternating current and with direct current, and the dependence of the apparent capacity upon the frequency, or upon the time of discharge when using direct current. He considered the true capacity to be that which would be observed with infinite frequency or with an instantaneous contact.

The apparent capacity decreases as the periodicity (reciprocal of frequency) is reduced, and also as the time of contact is reduced, and Mr. Curtis showed that the two curves (alternating and direct) plotted between capacity and time, if extrapolated, would intersect for zero time. This capacity is the true capacity.

To test the stability or constancy of the condensers, three of them were inserted in an evacuated receptacle and placed in a thermostat where the temperature could be held constant. These three condensers in several months showed a relative variation of less than three parts in a hundred thousand. Six others were in the thermostat but not subjected to a vacuum. These showed almost the same constancy, although a variation of capacity with atmospheric pressure has been observed. Four other condensers were not kept at constant temperature, but the observed values were corrected to twenty degrees, centigrade by using the known temperature-coefficient. These showed a variation of two or three parts in ten thousand.

It is thus evident that considerable precision can be obtained in capacity measurement if the condensers are used in a definite way under definite conditions.

Condensers made by depositing silver on mica showed a very noticeable change of capacity with applied voltage. Condensers of tin foil and mica do not usually show this variation.

In the discussion, E. B. Rosa stated that high temperature-coefficients and other undesirable properties can be overcome, and condensers intended for standards should be purchased under specifications of performance.

New Cable Directory.

The thirteenth annual edition of the "International Cable Directory of the World" is indexed and classified in English, German, French, and Spanish, and contains the cable addresses of thousands of corporations and individuals in every portion of the globe.

Students on Inspection Trip.

The senior class of the Rose Polytechnic Institute of Terre Haute, Ind., recently spent several days in Chicago in visiting industrial plants and engineering works. Before leaving, the students were given a banquet by the Engineers' Club.

CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

SOME EXPERIENCE IN FUSE DESIGN AND OPERATION.

BY JAMES A. SEAGER.

The work in the design of any portion of electrical apparatus can only be gauged by the actual results which are obtained by its used in practice. Many an ingenious and elaborate design which appeared faultless in the drawing office has broken down under the severe working conditions of the central station or the factory, and it is therefore worth while taking up one or two records of actual experience in the handling of fuses of various characters in order to give some indications as to the right lines upon which these should be constructed with reference to the actual working conditions. In this article it is not intended to advance any theory of design or construction, but simply to relate one or two experiences and to leave those interested in a position to decide for themselves the best course which should be pursued in order to eliminate the difficulties encountered.

The first example selected is intended to show that even at the present time the general state of information upon the subject of fuses is still very backward, inasmuch as the trouble occurred quite recently. A breakdown was caused on a section of an electric power distribution system, owing to a fuse blowing in a consumer's main cutout supplying the power circuit. This fuse was composed of an alloy of lead and tin, and was of heavy cross section without any provision being made for guarding it. Owing to the occurrence of an overload this fuse blew, and the metal sputtered on to the iron case surrounding the fuse, setting up an arc and causing a dead ground on the power current. The current was fortunately cut off by other fuses blowing on the network. In order to restore the supply again as quickly as possible, the mains engineer hit upon the ingenious expedient of putting in a copper fuse of equivalent carrying capacity enveloped in an asbestos guard drawn from the inner core of a piece of round soft steam packing. To prevent a recurrence of this accident, fuses were eventually installed of a cartridge type in which the fuse itself is totally inclosed in a case containing loose sandy material.

Mention has been made above of the use of copper wire for fuses. This is not an altogether unmixed blessing as it has been found that fuses which are subjected to periodic overloads of short duration become in course of time over heated and brittle, the result being that the copper breaks away at times when the current is not of sufficient intensity to warrant any such interruption of circuit.

FIG. 1.—METHOD OF INCREASING HEAT DISSIPATION OF FUSE.

In a high-tension supply at 3,000 volts, it was found that the high-tension fuse of a fifty-kilowatt transformer which was made up of four or five strands of No. 30 tinned copper wire, deteriorated very quickly even when the transformers were unloaded, and it was decided that this was due to the effect of heat on the mass of copper. In order to prolong the life the strands were not twisted together tightly along their length, but allowed to bulge at the center, as shown in Fig. 1. In this way plenty of cooling surface was given and the heat was dissipated quickly. In this way the life of the fuse was much prolonged.

One inherent difficulty with regard to fuses is that in many cases they are not sufficiently quick acting to deal with momentary overloads of a serious nature, and owing to the uncertain quality of their heat-conducting and dissipating properties the time element of a fuse cannot be very accurately predetermined. This as a matter of fact has been the cause of the large introduction within recent years of automatic switches of the magnetic release type inasmuch as the period of overload which they sustain can be predetermined within such very fine limits of accuracy.

An interesting comparison between the interrupting power of fuses and automatic cutouts was recently afforded at a substation on a power supply system which was principally devoted to the lighting and power apparatus of a large theatre. The substation is situated underneath the theatre which receives a supply direct from one phase of the low-tension switchboard.

The capacity of the substation is 200 kilowatts, divided between four transformers, converting from 3,000 volts to 200 volts. The automatic switches on the high-tension switchboard were adjusted so as to interrupt the current when a twenty-five per cent overload was reached. The theatre supply had a separate pair of fuses on the low-tension switchboard constructed of tin strip and calculated to fuse at a current of 300 amperes.

On the occasion specified the electrician in charge of the theatre was testing a small low-voltage transformer to be used for operating the stage spotlights on the circuit which was protected by a fuse of twenty-five amperes capacity. In some manner the electrician managed inadvertently to short-circuit the transformer. The effect of this accident was very curious. The twenty-five-ampere fuse in the theatre circuit did not blow; neither was the overload of sufficient duration to cause the 300-ampere tin fuse on the low-tension switchboard to melt; but the effect of the momentary short-circuit was to cause the high-tension automatic switch to trip out, thus interrupting the supply to the whole area affected. Fortunately the breakdown happened in the day time

so that only a few motors were stopped.

The substation engineer in the station at the time, seeing the automatic switch trip out and finding that the theatre circuit fuses were hot, drew these fuses before replacing the automatic switch and proceeded to make inquiries in the theatre, from which it was apparent that the momentary short-circuit had actuated the quick-acting automatic switch while the time element of the metal fuses enabled them to withstand the strain. After making certain that everything was clear for continued running the fuses were replaced.

Another fuse breakdown in a substation converting from high tension at 3,000 volts to a low-tension 200-volt supply at fifty cycles is instructive. The fuses on which the trouble occurred were connected to the low-tension side of a fifty-kilowatt transformer and fed by distributing means of the usual kind. The fuses were arranged to pass a maximum current of 300 amperes and were made of two pieces of strip copper, each half an inch wide, wedged into the fuse holders. It was found in operation that in several instances these fuses melted even when they were much underloaded according to the calculations of their current-carrying capacity, and after investigation it was found that the fault was due to the fact that they were secured in the holders with lead wedges. This lead, having a lower melting point than that of copper, began to run out when the fuses themselves were only moderately warm, and after the cause of the trouble was discovered, it was rectified by using wedges made of brass.

It is advisable that makers of fuses intended for extra-high-tension supply should take extreme precautions to insure that there is no possibility of electric leakage across the surface or through the material of the fuse holders. This remark is prompted by an experience which fell to the lot of the switchboard attendants on a high-tension supply and which for some time occasioned considerable uneasiness as to the reliability of the supply system. It was noticed that when one extra-high-tension fuse was placed in circuit it was possible, by holding one side of the other fuse near its contact, to draw out quite perceptible sparks. This was in spite of the fact that the switchboard attendant was at the time standing on a rubber mat and that he was wearing rubber gloves. The fuse insulators were made of porcelain supplied by a firm of considerable repute in this class of manufacture, and the occurrence may either have been due to high-tension leakage through the porcelain plug, the rubber gloves and the mat, which hardly seems conceivable, or owing to the condensing feature of the circuit upon which the fuses were placed. It may be mentioned that the occurrence happened in a transformer substation, the low-tension switches of the apparatus therein being at the time on open circuit.

A final word may perhaps be permitted on a point which is apparently only a matter of detail and which might nevertheless lead to considerable trouble due to shock. The accompanying illustration, Fig. 2, shows a usual form of construction for high-tension fuses with holders made of porcelain, so far as the handle is concerned, the ends being capped with gunmetal having projections to serve as lugs and connecting pieces for the fuse wires. In certain fuses of this type the whole cap and handle has been painted a uniform red in order to give it a good appearance and the effect is that the ends and the middle of the holder superficially appear to be made of the same material. The result is that the attendant, unless he is aware of the fact, is extremely liable to receive a violent shock due to careless placing of his hand in inserting or removing fuses.

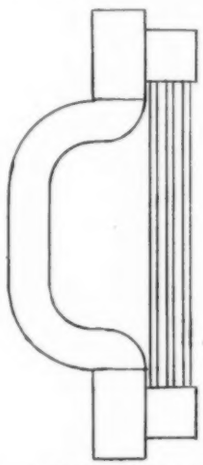


FIG. 2.—HIGH-TENSION FUSE.

The foreclosure sale of the Philadelphia & Chester Street Railway has been postponed from March 14 to May 1.

PRICE OF ELECTRICITY.[1]—II.

BY R. S. HALE.[2]

There is one case that frequently comes up, and that is that in an office building, the owners buy wholesale at the same price that, for instance, a town would buy, but the expenses of distribution from the basement of an office building to the offices are much less than they would be between a central point in a town and the final consumer along the roads.

It follows, therefore, that when the Edison Company goes into a big office building at the request of the owner, it could sell to the tenants retail at a very much lower price than it could in the towns of Natick or Wellesley, though, of course, not quite as low as the wholesale price at which it would sell to the town or to owners of the office building.

If, therefore, we followed out completely the theory of determining the cost in each particular case we would have a different cost in each town and in each block of buildings, since, when we have a very great many customers side by side our costs of supplying them are much less than when we have the same number of customers spread out over a large area.

If, however, we should attempt to make a different price in each section and each block according to the number of customers we had, or according to any other local reason, the differences would be very unsatisfactory and, fortunately, there is another feature in our expenses and costs that enables us to take care of this difficulty.

The reason is that in addition to all the expenses I have outlined that are actually increased every time a customer comes on our line, there are a great many other expenses. For instance, when we lay a main in a street we have at first only one or two customers on the street, and these perhaps use only one per cent of the whole capacity of the main. It would be bad engineering to put in a main so small that whenever a customer came on it had to be dug up and replaced by a larger one, and yet the excess cost of the large main put in looking towards

1 Abstract of a paper presented at the convention of the New England section of the National Electric Light Association, Boston, Mass., March 16 and 17, 1910.

2 General Superintendent Sales Department, Boston Edison Company.

the future growth can hardly be charged to the particular customer who uses it first, but must be spread over the whole business, or rather charged to those customers who, on the whole, get the benefit.

Another expense of this nature is the fact that many of our engines are of older type than the modern turbine, and involve considerably higher coal and labor cost. In our work we aim at keeping the total expense at a minimum. If we should throw away these old engines and put in turbines we could reduce our coal expense, but would increase our depreciation charge by an even greater amount, hence, we run the old engines until we can afford to scrap them. But it would not be fair to charge the extra coal due to running these old engines, only to the old customers for whom these engines were put in, and to give the whole advantage of the turbine to the new customers, hence this extra cost forms an item which must be distributed over the whole business and cannot be ascribed to any particular customer. When the City of Boston abandons a street and makes us abandon our conduits without compensation, that again is an expense that cannot be ascribed to any particular customer. Besides these three sample cases, there are many similar expenses.

The next question is that of power and why should power prices be different from those for light.

We use the same turbines, transmission lines, mains, meters, etc., and two customers may be using the same amount of current side by side, and the one that used it for power gets a much lower rate than the one who uses it for lights. Why should this be so?

There are two reasons, or classes of reasons, for this.

One is that power service requires much less care and attention than lighting service. For one thing we do not have any expense for renewal of incandescent lamps. We do not have to regulate the pressure as closely for power as we do for light, and that means that even when the current is supplied over the same wires, that the expense of the extra good regulation required for light should be collected as far as possible from our lighting customers.

These items, however, while important, are not the most important. The really important difference between light and power is that power is called for at any time during the work day, and, therefore, the result of all our power business, even if individual customers only use their portion of our investment a short time, is that our station and transmission line investment and much of our distribution investment is used steadily ten to twelve hours a day.

On the other hand, the same number of lighting customers instead of coming on at any time from 7 a. m. to 5 p. m., will practically, all of them come on some time between 4 p. m. and 6 p. m. in the winter, and will result in requiring a very much larger investment in proportion to the kilowatt-hours used. We can, therefore, afford to supply intermittent power at a lower rate than we can supply intermittent light.

When a power customer becomes even moderately large-sized, or a moderately long-hour user, he begins to be able to get his power in other ways. In other words, he ceases to get as much benefit from our service as a small user and cannot afford to pay as high a price per kilowatt-hour.

We, therefore, reduce his rate so that he can still afford to use our service, although he is not as profitable as a smaller customer in proportion to the kilowatt-hours used. On the other hand, he is a very profitable customer indeed, in proportion to the investment required.

The foregoing discussion has brought out the four most important principles that are used in making prices and these are:

First—That the customer who uses the investment a long time is much cheaper to supply, and is entitled to a better rate than the customer who uses the investment only a short time.

Second—That a large customer who does not require any large expenditure for distribution in proportion to the amount of service rendered, can be supplied at a very much lower rate than small customers who require a very large distribution expense.

Third—The third is in one sense an extension of the first principle, in that a customer who uses the service for power, even if the individual customer uses the investment a short time, produces the same result on the station, and, to a certain extent, on the distribution system, as though he used the investment a long time, and can, therefore, be supplied more cheaply than if the current is used for light.

Fourth—That there are a large number of expenses which cannot be classified and ascribed to any particular customer, or class of business, but must be paid somehow. By proper distribution of these unclassified expenses, we are enabled to smooth out our prices and rates and make them far more simple than we would otherwise have to do, and also make them more uniform as between individual customers.

One question that has been frequently asked of us in the last few years is, why we have made all the reductions in prices to the short-hour consumer and have made hardly any to the long-hour consumer.

A few years ago our ordinary lighting rate was eighteen cents per kilowatt-hour, and we have, by gradual steps, reduced this first to fifteen cents, then to twelve cents and now to eleven cents, and during this time the Hopkinson rate to our small long-hour consumers has remained at $60 a year fixed charge and five cents running charge.

If the eighteen-cent rate and the Hopkinson rate balanced each other four years ago, it would look as though we might be losing money on all of the eleven-cent business now, or rather on most of it.

The case is very similar to the old woman who sold apples and said that she lost a little money on each apple that she sold, but she sold so many that it more than made up the difference and gave her a little profit at the end of the day. Though we may apparently lose money on the eleven-cent business, yet we do not actually lose money, except on a small proportion of our customers. What happens is that the customers who pay eleven cents pay only a small proportion of the unclassified expenses, and these unclassified expenses are almost entirely borne by the customers who take the yearly and wholesale and power rates.

From some points of view it does not seem quite fair that a drug store should pay so much larger proportion of the unclassified costs than the residence, but, on the other hand, it is evident that the public prefers a simple, uniform rate, and the only way that we can have a simple, uniform rate is to let the drug store and similar business pay a large proportion of the unclassified expenses.

There is another question often brought up and that is why, as long as we have machinery lying idle in summer and in the early morning, we do not make a special price in order to have that machinery used.

Electric-vehicle people, for instance, are all the time coming to us and asking for a special price, in consideration of their agreeing not to use current at the time of our peak.

The reasons why we do not make any concession in this regard are as follows: The first being an Irish reason in that we already do do it.

If a customer takes service from us at our ordinary lighting rate, he pays eleven cents, but if he takes service at our so-called yearly rate he pays a fixed charge and then gets all the electricity he uses at five cents, or less than half price. We have thousands of such customers, and if there were really any general demand for a low rate for current "off the peak" all that is necessary is for the people who want it to go to these customers of ours and get them to re-sell the electricity at six cents, making twenty per cent profit. In fact, by reason of our power rate and wholesale rates, there are thousands of places than can sell current at three cents or less in Boston "off the peak."

While this feature of our price does take care of a great deal of vehicle charging in Boston, it does not satisfy the people who want us to put in a separate line and new service for them, and sell to them at a low price, because they will use it "off the peak." If we have to put in a special service, it is clear that so far as that service goes, and probably as far as the transformer and part of the distributing system goes, such supply is not "off the peak" in the sense that no investment is needed. Even in the case of the customer whose service is already in, but who pays eleven cents for all he uses, we must remember that the only reason we can afford to let him use current at the peak at eleven cents is that we know from experience that we shall also sell enough current "off the peak" at eleven cents to bring us out whole, and a lower "off the peak" price therefore means an immediate cut in income, unless we could devise some means so that our present "off the peak business" shall still pay full prices.

I do not mean that it is not wise to encourage "off the peak" business, since whenever we can fill up the valleys in our load curve, it means more income with no more investment.

On the other hand we must sell, and are today selling, a good deal of current "off the peak" at much more than bare operating expense in order to be able to sell "on the peak current" at eleven cents. If we make any lower price for "off the peak" than we are today making, we must remember that it will cut off some of our present income, and whenever we consider any "off the peak" price, we want to be shown that its final result will be favorable to the whole of our business.

A New Method of Stringing Wires.

With the general aim of beautifying the streets by removing all unsightly poles and overhead wiring, the Rochester (N. Y.) Railway and Light Company has recently devised and put into execution a new system of wiring, known as the rear-lot, pole-line construction. The new system is being employed especially in the rapidly growing residential sections, notably in the southeastern part of the city, which is being covered with dwellings of the most modern type.

In this method of construction, the wires are strung from poles erected in the backyards of the houses. As in other main streets of the city, underground conduits, containing telephone and lighting wires, are run through the principal thoroughfare of the section to be supplied. At each intersecting side street, a branch of the main cable is used to furnish power for the houses on that street. It would be impossible to run the wires on these side streets through underground conduits, for the reason that it would necessitate a manhole in front of practically every house to keep the wiring in good condition. Therefore the wires carrying the power are run under the first house on the street to the rear of the lot, and, by means of overground poles, distributed to every house on the street. In this way the streets, free from overhead wiring, present a beautiful appearance.

The street arc lights are hung from ornamental iron poles, and are supplied by underground wires, strung from the nearest back yard source. Superintendent Yawger, under whose direction the new system was devised, believes that eventually the method will be used all over the city. He is receiving requests almost daily from the best districts to have the wires strung in that way in those parts. A new district lying in the vicinity of Winton and Blossom roads, consisting of over two hundred building lots, and with houses containing electric lighting, telephones and other electrical conveniences, is to be supplied entirely in this way.

Southern Power Company to Install Steam Auxiliary Plants.

Contracts have been awarded by the Southern Power Company for steam-power machinery required in the equipment of two auxiliary plants of 10,000 horsepower each. This is the third contract of the kind, an earlier one having been recently placed for a 10,000-horsepower station at Greenville, S. C. An auxiliary steam plant at North Charlotte, N. C., of 2,000 horsepower, was recently completed.

The policy of the company is to erect these steam plants, as auxiliary installations, in order to guarantee the supply of electrical power in case of low water in the rivers. The company will shortly add a 24,000-horsepower generating plant at Ninety-Nine Islands, in the Catawba River. On the same stream are already erected a 10,000 horsepower plant at Great Falls, and one of 32,000-horsepower at Rocky Creek, giving the company a total capacity of 100,000 horsepower. The more southern of these plants will supply power for the Greenville, Spartansburg & Andersonville Railway, an interurban line being constructed in the Piedmont district of South Carolina.

Another Isolated Plant Goes.

The building of the Continental Trust Company in Denver, Col., has discontinued its isolated plant and now takes its electric service from the outside mains. This action is attributed to the closing of an order for a large electric sign in front of the building by a representative of the electric-light company.

Cost of Philadelphia Strike.

The cost of the Philadelphia Rapid Transit Company strike, to the company, is estimated at $1,200,000; to the original and sympathetic strikers, $3,000,000; and to the business community, mostly retail dealers, $8,000,000.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE EFFECT OF REGULATION ON INCANDESCENT LAMPS.[1]

BY L. L. ELDEN.

While the manufacture of incandescent lamps has been reduced to an almost exact science, as far as the quality and performance of the manufactured product at rated voltage is concerned, there still remains for the operating companies the problem of devising means to maintain that rated voltage at the consumer's premises under conditions which conserve fairly the interests of both company and consumer.

The most important characteristic of the incandescent lamp is the effect on its various properties of any variation in the applied voltage, from that voltage for which the lamp is normally designed. If we may assume an ideal condition of service supply wherein the proper voltage, without variation, is supplied continuously to a customer's lamps, the conditions are then fair to both parties concerned, but any variation from that standard voltage is a disadvantage to both consumer and company, whether the voltage variations are above or below standard voltage—if the delivery of the normal rated candlepower of the lamp is the basis of comparison.

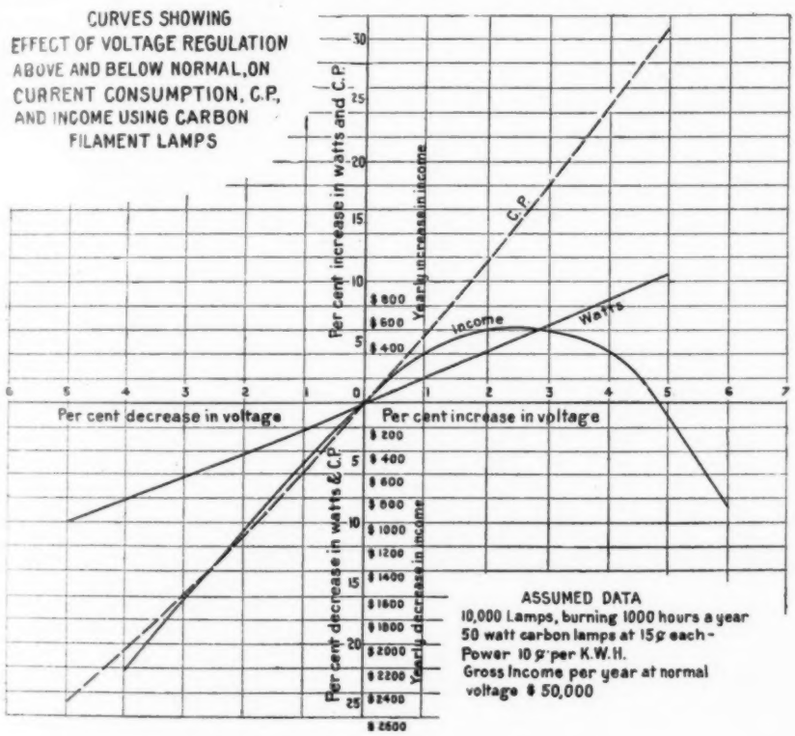

CURVES SHOWING
EFFECT OF VOLTAGE REGULATION
ABOVE AND BELOW NORMAL, ON
CURRENT CONSUMPTION, C.P.,
AND INCOME USING CARBON
FILAMENT LAMPS
Per cent increase in watts and C.P.
Yearly increase in income
C.P.
Income
Watts
Per cent decrease in voltage
Per cent increase in voltage
Per cent decrease in watts & C.P.
Yearly decrease in income
ASSUMED DATA
10,000 Lamps, burning 1000 hours a year
50 watt carbon lamps at 1.5 ℊ each -
Power 10 ℊ per K.W.H.
Gross Income per year at normal
voltage $ 50,000

FIG. 1.—VOLTAGE-REGULATION CURVES.

In actual commercial practice it is impossible to maintain all parts of a distributing system at exactly the precise voltage for which the lamps are rated, and, therefore, it has become standard practice to assume an allowable variation of two per cent in either direction from the standard voltage; such variation not producing sufficient change in illuminating values to be ordinarily visible to the eye. While even this small variation produces no visual effects, on either consumer or company, a glance at Fig. 1 shows that the physical and financial interests of both parties are materially affected. In the present article, carbon-filament lamps only have been considered, all data being based on the characteristics of that type of lamp. Tungsten and other types of metallic-filament lamps, while showing somewhat more favorable results under variable-voltage conditions, still yield the same general results; but on account of lack of data and experience in actual practice, it was not deemed best to attempt to consider other than the carbon types of lamps at this time. Lamp-renewal charges in these comparisons are based on standard practice of renewal of lamps when their candlepower falls to eighty per cent of initial value.

It is apparent from consideration of Figs. 1 and 2 that a reduction of two per cent from normal voltage reduces the candlepower eleven per cent and the watts only 4.3 per cent and increases the life of the lamp fifty-three per cent. This condition might be regarded as a disadvantage by the consumer in that the consumption of energy is not reduced at the same rate or in the same proportion as the candlepower, while the life of the lamp is lengthened. If the voltage is maintained at two per cent in excess of normal, the candlepower is increased 11.6 per cent and the watts 4.2 per cent, while the lamp life is shortened 33.6 per cent and the cost of lamp renewals is increased fifty per cent. In this case, the consumer benefits by receiving excess candlepower without a corresponding increase in current consumption, while the company is penalized by increased lamp renewals and early blackening of lamps. Consideration of percentage variations in voltage in excess of two per cent from normal shows conditions rather unfav-

[1] From the National Electric Light Association Bulletin, April, 1910.

orable to the interests of all; yet variations of three per cent or even greater percentages are by no means unusual in some of the smaller distributing systems. A consumer whose service voltage was regularly five per cent high would, in the absence of proper information, and disregarding the thirty per cent increase in candlepower, have reason to believe that his meter was running fast, as the energy consumption would be ten per cent in excess of normal, while a consumer whose voltage was five per cent low would be receiving but seventy-five per cent of normal candlepower, at the same time consuming ninety per cent of normal current, a condition not tending to cordial relations between consumer and company.

tain number of lamps both over and under voltage, is shown by the income curve in Fig. 1.

Assumed data are as follows:

Circuit with connected load of 10,000 lamps.

Average hours burning per lamp per year, 1000 hours.

Cost per lamp, fifteen cents.

Selling price of energy, ten cents per kilowatt-hour.

Lamps to be renewed when they reach eighty per cent of initial candlepower.

From the curve it appears that an operating voltage below normal results in a direct loss to the company, while excess voltage results in a gain to the company which reaches a maximum at two per cent above normal and a minimum at 4.8 per cent above normal, any further increase in volts resulting in a direct loss.

EFFECT OF VARIATION OF VOLTAGE ON THE MULTIPLE CARBON AND GEM LAMPS*

Per Cent	Per Cent Candle-Power		Per Cent Total Watts		Per Cent Watts per Candle-Power		Per Cent Amperes		Per Cent Useful Life	
Volts	Carbon	Gem	Carbon	Gem	Carbon	Gem	Carbon	Gem	Carbon	Gem
90	56	62	80.7	83.5	144.8	134.9	90	92.8	860	568
91	59	65	82.8	85	139.2	131.4	91	93.5	680	477.8
92	63	68.5	84.5	86.8	134	127.1	92	94.3	550	465
93	67	72	86.5	88.4	128.9	122.8	93	95	430	337
94	71	75.3	88.4	89.9	124.2	119.2	94	95.6	350	288.5
95	75.2	79.4	90	91.5	120.4	116	95	96.4	285	240
96	79.6	83.2	92	92.7	115.8	112.4	95.9	97.1	230	192.5
97	84.2	87.3	93.8	95	111.2	108.8	96.9	97.9	187	166
98	89	91.4	95.7	96.5	107.8	105.7	98	98.5	153	141.0
99	94	95.8	97.7	98.3	103.9	102.8	99	99.4	125	116.0
100	100	100	100	100	100	100	100	100	100	100
101	105.5	104.5	102	101.7	97.4	97.3	101	100.7	84	86.0
102	111.6	109.2	104.2	103.5	93.3	94.7	102	101.4	66.4	75.1
103	118	114	106.3	105.1	90	92.4	103	102.1	54.8	65.3
104	124.4	119	108.4	106.9	87	90	103.8	102.8	45.7	54.4
105	130.5	124.2	110.3	108.7	84.2	87.5	104.6	103.5	37.5	45.7
106	138	129.7	112.6	110.05	81.3	85.3	106.1	104.3	31	39.8
107	145	135	114.8	112.5	79	83.3	107.1	105	25.9	33.9
108	152.6	140.8	117	114.2	76.4	81.2	108.2	105.7	21.4	28.8
109	160	146.4	119	116	74.2	79.1	109.2	106.5	18	25
110	168.4	152.2	121.1	118	72.3	77.6	110.3	107.2	15	22.0

* 100 per cent useful life { Carbon—475 hours / Gem —575 " } 100 per cent watts per candle-power { Carbon—3.1 / Gem —2.5 }

FIG. 2.—TABLE OF VOLTAGE VARIATIONS.

A ready method of analyzing the results of variations in voltage is as follows:

Increase in volts from normal —.

Watts increase 2 × per cent increase in volts.

Candlepower increase 6 × per cent increase in volts.

Decrease in volts from normal —.

Watts decrease 2 × per cent decrease in volts.

Candlepower increase 6× per cent decrease in volts.

The effect on the income of a central station, due to the operation of a cer-

The net income curve in Fig. 1 indicates results when operating lamps continuously at certain definite percentages of normal volts, as in a testing laboratory. Commercial conditions of operation must allow for variations in pressure at source of supply, in the distributing system, and those due to the various translating devices employed.

For example, consider the circuit previously described, and operate it without regulation from a source of power which maintains a fixed potential on the 'bus at all times, and assume a maximum line drop of ten per cent at maximum load, and an average load-factor of twenty per cent, resulting in an average line drop of two per cent.

Upon this assumption, twenty per

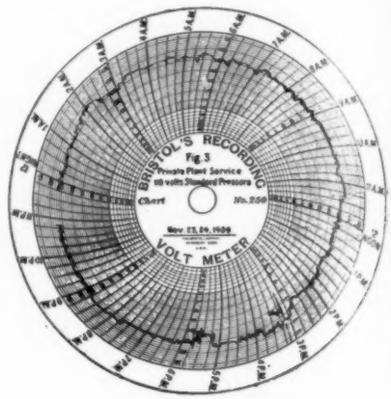


FIG. 3.—VOLTAGE CHART.

cent of the lamp-hours would be consumed by lamps burning eight per cent above voltage, this resulting in an increased lamp-renewal charge to the company of $2,320, but with a credit of $1,700 for excess current sold, leaving a net loss to the company of $620 per year on that part of the output of the circuit. Consideration of the

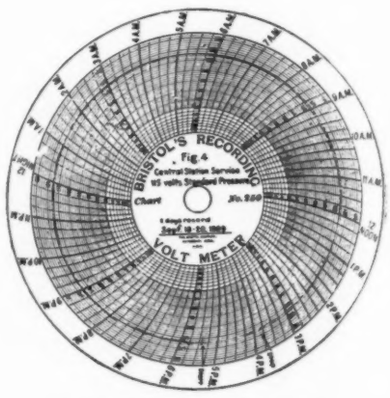


FIG. 4.—VOLTAGE CHART.

remainder of the output of the circuit at other than the time of peak load will add proportionally to the company's losses on account of excess voltage. To avoid this loss, by providing means of maintaining normal pressure at the lamps, regulating apparatus costing $2,000 may be added to the circuit. Assuming this regulator

to be of ninety-five per cent efficiency, current used by the regulator at one cent per kilowatt-hour, and allowing for interest on the regulator investment at five per cent, and depreciation at five per cent, the fixed charges due to the use of the regulator will amount to $420 per year, all of which is a loss to the company, but a saving of $200 over the operation of the unregulated circuit at twenty per cent load-factor.

In actual practice it is advisable to operate a system of incandescent lamps slightly above normal in order to insure perfect service to the consumer; and from the income curve in Fig. 1 it will be noted that an average of one per cent increase in volts above normal would compensate for the entire loss due to the use of the regulator on that part of the load of the circuit under consideration.

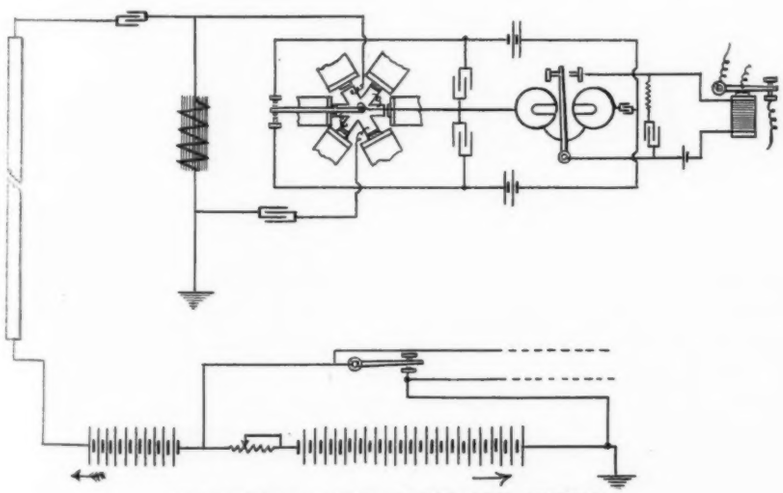
The subject of the regulation of incandescent lighting service is one which deserves careful consideration, whether the service be from a central station or from a private plant. That this is not always the case is well illustrated by the voltage chart Fig. 3, taken from the service of a well-known private plant showing a quality of service which would not be accepted from a central-station company. Fig. 4 is a chart taken from the lines of a central-station company forty miles from the powerhouse, on a circuit equipped with automatic regulators and operating a mixed load of incandescent lamps and motors.

TELEPHONY—TELEGRAPHY, *and* WIRELESS.

THE KITSEE CABLE RELAY.

FIRST CABLES RECEIVED BY COMMON SOUNDER.

A test of the Kitsée cable telegraphy system, the invention of Dr. I. Kitsée, of Philadelphia, was made on April 24, between New York city and Canso, Nova Scotia, a distance of 800 miles. The messages were sent in American Morse by means of the telegraph key, and received with the aid of the sounder in the usual manner. The speed was from thirty to thirty-five words per minute, and the signals were clear and distinct. This cable has, in round numbers, a KR. (total capacity) of 2,000,000.



THE KITSEE CABLE TELEGRAPHY SYSTEM.

At the beginning of the test at the cable office, 16 Broad Street, New York, the following message was received:

CANSO, N. S., April 24, 1910.

CHAS. W. PRICE, Editor,
ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, New York.

Greetings to the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN from Canso, Nova Scotia, over submarine cable with the Kitsée relay, the first time in the history of cable telegraph that signals were received by a common sounder.

EDWARD P. EARLE, Operator.

The message was received by Joseph Wiseman, of the cable office at New York, in the presence of William Flynn, of the electrical department of the Western Union Telegraph Company, a representative of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Dr. Kitsée, and others.

It is comparatively easy to telegraph over land lines and even over cables of comparatively short length, but even on land lines, it would be impossible to telegraph direct from one city to another city, if these cities are very far apart, were it not for the employment of the "sounder" or instrument alike in its action.

When a telegraph line overspans two cities comparatively far apart, it is cut into shorter sections and when the operator of the first section telegraphs with the aid of the key at one terminus of the line the sounder at the other terminus of his section is made to perform the function not only of a sounder but also of a transmitting key. A new source of current is connected through the sounder to the second section in such a manner that impulses are sent over the second section in just the same manner as the operator of the first section transmitted over his own section with the transmitting key.

In telegraphic parlance such action is called "automatic repeating." This automatic repeating makes it possible to telegraph even from New York to San Francisco, a distance of several thousand miles, without necessitating the aid of operators other than in New York or San Francisco.

In submarine telegraphy, no sounder can be employed and the transmitting key cannot transmit (as on land lines) dots and dashes, to be delivered as such at the receiving end, and for that rea-

son, it is impossible today to repeat from a land line to a cable or from a cable to a second cable and the messages have to be taken down verbatim by an operator at each end of each cable or section thereof.

The "repeating sounder" or "repeating relay" embraces a movable tongue and stationary contacts and its action is such, that for one impulse the tongue makes connection with one contact and for the other impulse with the other contact. This action of the repeating sounder can only be brought about when the current arriving is not fluctuating and when the line is normally clear. The tongue at such moments will rest at its normal position and this normal position is called the "zero." On land lines, the zero position is always at the same point and, therefore, not movable.

In cable telegraphy, the current is always fluctuating and there are always electric ripples, so to speak, moving the movable part or tongue of the receiving device from one place to the other, and the impulse which arrives at the receiving station is always fluctuating in itself, and the tongue, therefore, moves sometimes a greater distance and sometimes a lesser distance. Such action is called the "moving of the zero" and it is obvious that with such moving of the zero, an instrument with stationary contacts cannot be used. Therefore, on submarine cables, the employment of sounders, repeating sounders or relays, such as are used on land lines, is out of the question with the cable system of today.

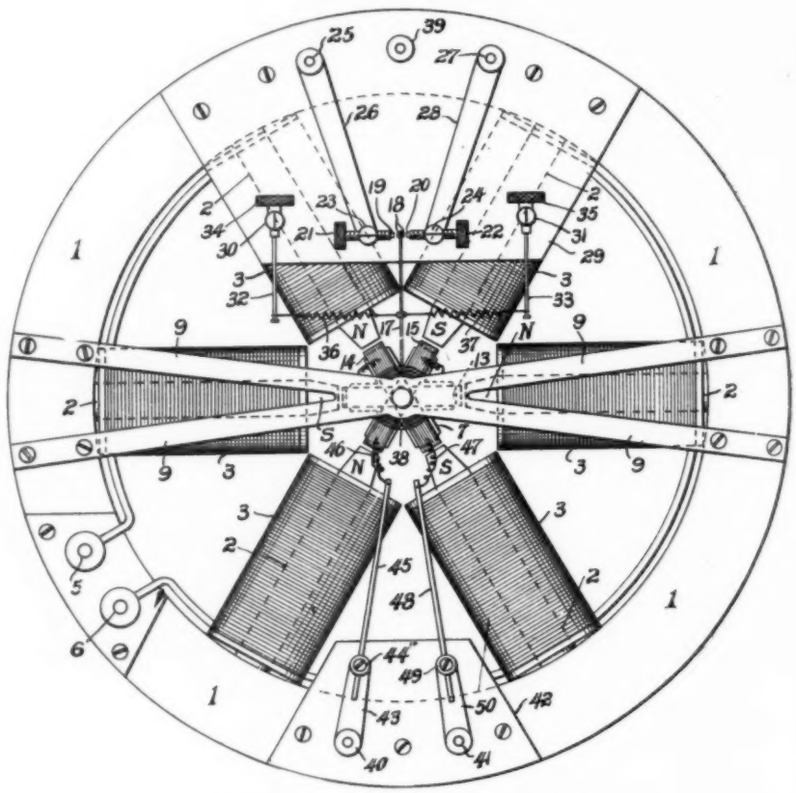
The Kitsée system changes in cable telegraphy the "moving zero" into a "stationary zero" and, therefore, the employment of sounders or repeating sounders is a possibility; but as in cable telegraphy only comparatively weak currents can be used, it was necessary to produce a device sensitive enough to act on such weak currents and yet stable enough to produce always a good contact.

The Kitsée system changes—telegraphically speaking—submarine lines into ordinary land lines and automatic repeating may be carried on for as many sections as desired, and a man living, say, in Chicago, could therefore be brought into direct contact with a man living, say, in Berlin, Germany, and the operators of both cities could communicate directly with each other without the intervention of any intermediate operator. With the system of today, such an arrangement is an impossibility.

The arrangement to produce such effect is given as follows:

At the transmitting station two sets of batteries, one set of about double the electromotive force of the other set, are connected in opposition as to each other and in series with the cable. The set of higher electromotive force is provided with a shunt, this shunt being provided with an ordinary telegraph key. For all practical purposes, the operator manipulates his telegraph key in the same manner as he manipultes his key on land lines. He closes the key for a short time to transmit a dot and for a longer time to transmit a dash. Through this arrangement, impulses of opposite direction—true reversals—are transmitted over the cable.

At the receiving station, a condenser is inserted in the cable and the cable is then grounded with the interposition of an impedance. The line relay is not connected directly to the cable, but is connected in a shunt around the impedance. This shunt embraces:—First, the relay and then a capacity. To this relay is connected a highly wound polarized relay of the Siemens type. Each forward stop of the line relay is connected to a source of current, one source in opposition to the second source. These sources are connected together and their junction is connected with the interposition of a condenser to one terminal of the coil the polarized relay. The second terminal of the polarized relay is connected to the tongue of the line relay. Condensers overbridge the circuits of the tongue and forward stop of the line relay. The tongue of the polarized relay is connected with the interposition of a battery with one terminal of the coil of a telegraphic sounder of the regulation type. The second terminal of the coil of this sounder is connected to one of the forward stops of this relay. The circuit is shunted with the aid of a condenser and resistance.



RELAY USED IN THE KITSEE SYSTEM.

The line relay is of a peculiar type and consists of a circular yoke of iron and secured thereto are six radially extending cores alternately with opposite poles. Upon these cores are disposed windings connected in series with each other and the terminals of these windings are connected to binding posts for the purpose of joining the same with a suitable exciting circuit. Disposed between these pole pieces is a stationary

core of iron supported by brass screws to the frame proper. Upon the top of the yoke is secured a bridge or bracket of brass and upon the underside is secured a similar bridge or bracket.

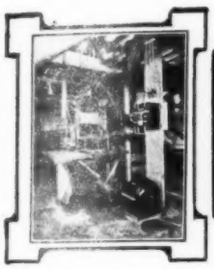
At their centers, these brackets support carefully ground jewels and in these jewels are journaled the supports for three movable coils. These three coils are disposed of at an angle with respect to each other. Their terminals are connected to binding posts resting on the frame and are adapted through these binding posts to be connected to the cable. The support of the three coils carries a tongue or arm, and in proximity to the end of this tongue are stationed two contact points.

The arrangement is shown in the accompanying illustration.

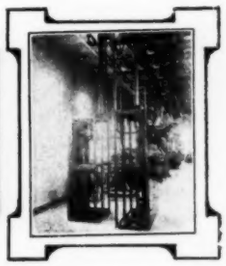
A German Wireless Feat.

A wireless station near Berlin, Germany, claims a wonderful record in the transmission of messages. It is reported that this station recently succeeded in maintaining communication with an ocean liner during its entire passage from Hamburg to the German protectorate of Kamerun in West Africa. The greatest distance signaled was about 4,000 miles. The messages had to pass over the Alps, the Algerian tableland, and the Adamana range.

An electric meter has been invented to keep track of the number of seconds any telephone is in use during the day.

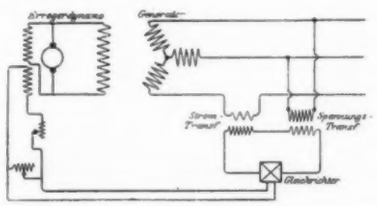


Industrial Power



Method of Compounding Alternating Current Generators by Means of Mercury Vapor Rectifiers.

Some of the methods of compounding alternators which have so far become known, are based on the idea of converting the alternating current flowing through the line into direct current by means of rotary converters, and employing it for strengthening the excitation of the generator. The well-known compounding transformers, each consisting of a current—and a tension-transformer, furnish an alternating tension variable with the load, which is transformed by the converter into a proportional direct tension and thus supplies in a simple manner the direct current necessary for the excitation. In this method it is the same in principle, whether the exciter or generator itself is compounded. In an analgous manner mercury vapor rectifiers, which have lately come into extensive use, may be made to take the place of the rotary converters for regulating the tension. The capacties for which vapor rectifiers are now built are sufficient for the purpose, and experiments made with the same have given satisfactory results. The accompanying diagram shows the circuit connections. In order to make the necessary capacity of the rectifier small, the exciter only was provided with a compound winding. At no load on the generator, under normal tension, the alternating current pressure at the rectifier is lowest. The resistance of the direct current circuit must be so dimensioned that the rectified current does not fall below the minimum value required for the steady operation of the rectifier, which condition can always be attained. As regards reliability of operation with rectifiers, their life of 2000 to 3000 hours guaranteed by the manufacturers is generally exceeded. The exchange of a bulb which has become useless causes little expense and no interruption of the service, as hand regulation may be resorted to for a short time. The facts that the rectifier does not require special attention, has no wearing parts, regulates itself automatically at all loads and displacements of phase instantaneously to constant tension, and its relatively low initial cost are all favorable to the employment of the arrangement described.—*Abstracted from Elektrotechnische Zeitschrift, Berlin, January 20, 1910.*



GENERATOR-RECTIFIER ARRANGEMENT.

Storage-Battery Locomotive for Use in Mines.

A unique type of storage-battery locomotive, for which are claimed several marked advantages over those operated by overhead trolleys or third-rail conductors, is now in use in a large number of important German and Hungarian mines. These locomotives, says *The Engineering and Mining Journal*, are thoroughly reliable, and without question less dangerous to the miners than the usual locomotives, as they eliminate the need of any exposed conductors. They also have a large sphere of action without extensive overhead construction.

The locomotives are equipped with motors of from eight to thirty-two horsepower capacity. Each locomotive is provided with two sets of batteries when uninterrupted service is required. The batteries are mounted on the top and are removable for charging. The gearing for this purpose is of special design, with permanent rolls fixed in the locomotive frames directly above the truck. By providing this equipment it is possible to shift the discharged batteries and replace them with fully charged sets with a minimum expenditure of time and labor. One storage battery is charged in the charging room, while the other is operating the locomotive in the mine.

It is stated that the storage batteries used seldom discharge more than sixty or seventy per cent of their capacity, and it requires, for charging, only about one-third of the time usually taken for discharging when in operation. Partially discharged batteries

may be fully charged in about one and one-half hours.

The mining locomotive of this type of twenty-horsepower capacity has two batteries of ninety cells each, the capacity of each cell being seventy-four ampere-hours. They are capable of operating 400 effective ton-kilometres on a single charge.

The cost of operation is from one-third to one-half the cost of animal power, it is claimed, and the current required is from one-fourth to one-third kilowatt-hour per ton-kilometre. A further advantage of these equipments over the trolley and third-rail mining locomotive is that no added weight is needed for adhesion, as the storage battery provides all the necessary weight required.

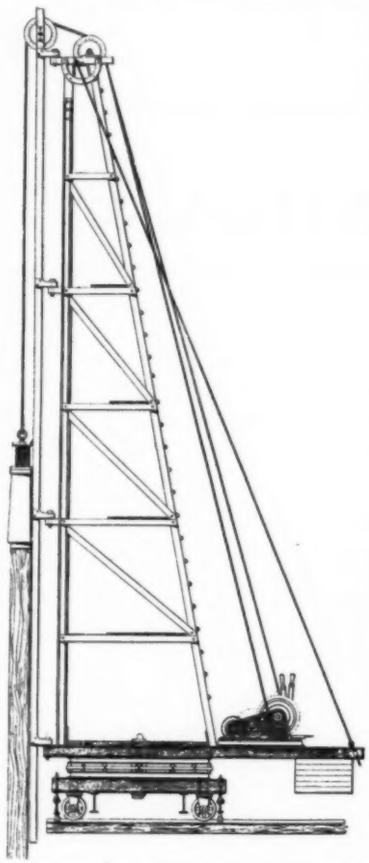
Five of these storage-battery locomotives are in use at the Konigsborn mines, near Heesen, in Westphalia, Germany. Eight storage batteries are provided, each having eighty-one cells of a capacity of seventy-four ampere-hours. In the Hungarian Petroseny mines, there are eight battery locomotives in operation. These locomotives are working in pairs. The double units thus formed are capable of hauling forty coal cars without difficulty. At these mines there are used sixteen sets of batteries, of the Tudor type. Each locomotive has fifty-one cells, with a capacity of seventy-four ampere-hours each.

Electricity Succeeds Where Other Means Failed.

An electric plant has just been installed at Canonbie Colliery, Dumfriesshire, Scotland, by the proprietor, the Duke of Buccleuch, says the London *Electrical Review*. The chief object is to recover the good coal, below the level of the pit bottom, which had to be abandoned twenty or thirty years ago, owing to the lack of mechanical means of haulage and pumping power. The new plant includes a high speed engine and dynamo giving eighty-seven amperes at 500 volts. The current is carried down the shaft for about 600 yards, and drives a haulage which brings the coal up in rakes to the level of the pit bottom. The supply down the shaft is carried on a circuit of double-armored cables. The new plant also deals with water, there being a three-throw pump, driven electrically.

An Electrically Operated Piledriver.

The application of electricity in the building trades is daily becoming greater and the portable or semiportable steam engine is slowly but surely being displaced by its ubiquitous rival, the electric motor. The small size for a given horsepower of the electric motor, its portability, flexibility in operation, readiness to start or stop at any time without trouble, economy in work-



ELECTRICALLY OPERATED PILEDRIVER.

ing both in current consumption and cost of attendance are all in its favor, and its reliability is unquestioned.

One of the latest applications of the electric motor, that of operating a piledriver, is depicted in the accompanying illustration which shows a machine recently introduced with success by an English firm. This apparatus is fitted with a revolving frame and swivel leaders.

As may be imagined the mechanical gripping device for the monkey is replaced in this electric piledriver by an electromagnet, the top of the monkey being made smooth and level so as to afford a good contact surface. The hoisting crab is operated by an electric motor the circuit of which also includes the magnet, the switch for the latter being attached to the crab.

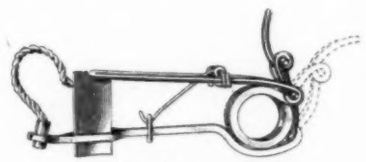
The whole arrangement is decidedly neat and workmanlike, and the many advantages of the electric piledriver will undoubtedly bring it quickly into favor with the contracting engineers.

Electric Cranes Wanted.

A business man in a Latin-American country advises an American consular officer that he will be glad to receive correspondence and catalogues, in Spanish, regarding hoisting apparatus of all kinds, especially cranes for carrying large quantities of wood. Several electric cranes will shortly be purchased by the party in question. Particulars can be obtained by writing to the Bureau of Manufacturers, Washington, D. C., quoting File No. 4789.

A New Brush Holder.

In the accompanying diagram is shown a view of the Wooliscrofts patent brush holder which is being used on direct-current machines manufac-



A NEW BRUSH HOLDER.

tured by a well-known Liverpool (Eng.) firm. This holder is extremely light and flexible and can be fixed immediately into position without the aid of tools. A long carbon feed is provided, and the pressure on the holder can be adjusted to suit requirements. There is also a hold-off position. The brush holder is secured to the rocker spindle by means of a powerful toggle clip.

The Electric Soldering Iron in Building.

All of the soldering of the sockets being installed in the crown cornice of the new building at Fifteenth and Champa streets, Denver, Col., is being done with an electric soldering iron. This is a good instance of the saving in labor and time which can be accomplished by taking advantage of the existence of the lines of the local electric light company in all alleys. The difficulties in doing this particular soldering work with any other means than electricity would be almost insurmountable.

The Selenium Cell.

The lecture given by William J. Hammer before the Engineering Society of Stevens Institute on March 15, brought vividly into view some of the possibilities of the selenium cell as well as a few of the things that have already been accomplished. Mr. Hammer has given the subject of the selenium cell and its application more study than any other man in America. He is at present at work on a bibliography of this element, which will be of international importance. In the course of his lecture before the Institute, he spoke of the vast possibilities which rest with the development of the selenium cell. A beam of light could be used to regulate an electric generator, a signal light on a railway might be made to stop all trains or certain trains, light buoys might be automatically lit and extinguished, and numberless operations performed.

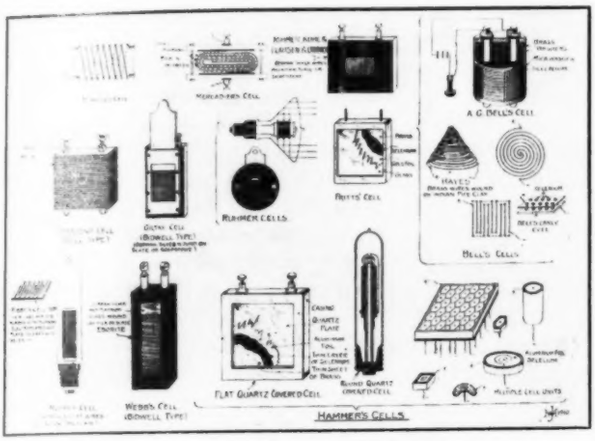


FIG. 1.—SOME FORMS OF THE SELENIUM CELL.

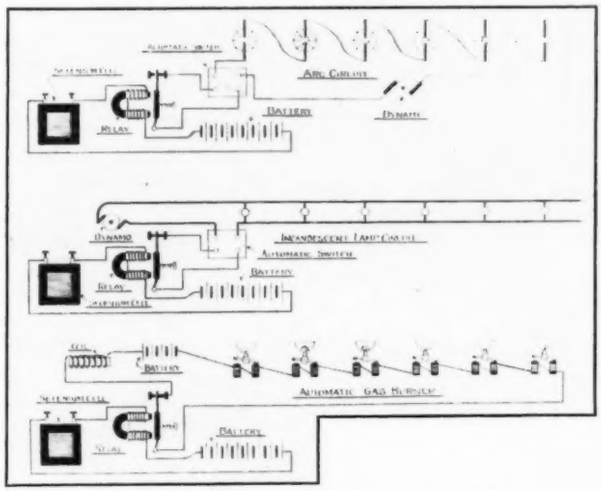


FIG. 2.—SYSTEM FOR CONTROLLING LIGHTS.

FIG. 3.—SELENIUM PHOTOMETER.

As is quite well known, the element selenium exists in two forms, being changed from one to the other by the action of heat. In the first form it has an extremely high resistance, and in the other it is a poor conductor in darkness but on exposure to light the resistance becomes much lower.

The cell itself is generally made by wrapping two wires, preferably of German silver, brass, nickel or platinum around a plate of soapstone or fibre. The selenium is then heated and smeared over the wires, forming a bridge between them. This, however, is the simplest possible form of cell, and some of the variations may be seen by reference to Fig. 1. All of these cells are the same, in that their resistance is materially lowered by the action of light. Various theories have been advanced to account for the remarkable phenomenon, one being the formation of conducting selenides and another the formation of conducting crystals.

Such a substance may then be used, with a suitable relay to start a motor or light lamps by means of a ray of light. Such an arrangement is shown in the three diagrams of Fig. 2; the selenium cell in each case being connected in a battery circuit so that any light on striking the cell, opens the lighting circuit, or in the case of gas lights, turns down the gas. The lamps might then be automatically turned off by the sun and lit at sunset.

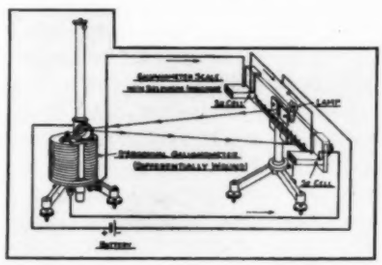


FIG. 4.—SELENIUM DAMPER.

Another use which may be made of a selenium cell is in photometry. Supposing that two lights are to be measured as in Fig. 3. The selenium cell, with a galvanometer in circuit, is placed where the light from a standard lamp is reflected upon it. The galvanometer deflection is noted and the cell moved into the light, of which the intensity is to be measured. The lamps are then so adjusted that the deflection is the same in each case. From the distances the relative intensities are computed. The use of the cell as a damping device fo a galvanometer is shown in Fig. 4. As soon as the beam of light swings to the selenium cell at either end of the galvanometer scale, current flows through the differential winding of the galvanometer giving a damping effect.

It is desirable in many cases for a doctor to keep stethoscope records of a patient, and Fig. 5 shows an arrangement making this possible. The selenium cell is in this case acted upon by the manometric flame which vibrates with the patient's heart beats.

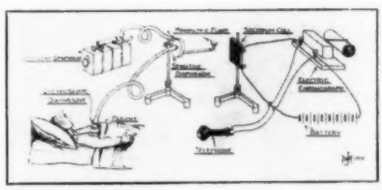


FIG. 5.—RECORDER IN STETHOSCOPE.

The use of the cell as a means of seeing long distances over an electric circuit has not yet been fully developed by Mr. Hammer. Cells for this use are constructed on the multiple system, each being in an independent circuit. Light focused on a certain one of the cells is produced at the other end of the circuit in like position.

AM ONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE ELECTRICAL CONSTRUCTION COMPANY has been organized at Miles City, Mont., with Thos. E. Fitzgeral, as manager. C.

THE REX ELECTRICAL SUPPLY COMPANY has been incorporated at Joplin, Mo., with a capital stock of $10,000. P.

THE TERRELL-HEDGES COMPANY, Chattanooga, Tenn., was awarded the contract for wiring the plant and residences belonging to the Fort Payne Fuel and Iron Company. B.

CHARLES I. ALEXANDER & SONS of Lawrence, Mass., secured the contract for wiring the plant of the Salem Manufacturing Company. The company will generate its own power.

THE H. P. CUMMINGS CONSTRUCTION COMPANY, of Ware and Boston, Mass., was awarded the contract for the construction of the addition to the Rumford Falls power station. The company has held a large contract with the power company for a number of years.

THE EL DORADO SUPPLY COMPANY, El Dorado, Ark., started in the electrical contracting business on April 10. The company carries a general line of electrical goods and is equipped to do all kinds of wiring. D. H. Fulton of St. Louis, is manager of the company.

RHODES BROTHERS, merchants of Tacoma, Washington, are contemplating the installation of a private power plant of two hundred and fifty kilowatt capacity in their store. The company would be glad to receive plans and estimates for the installation of the plant.

ANDREW M. MOORE, of Ellsworth, Me., has been awarded the contract of installing the lighting system in the large new business block of Lyford & Royal at Bar Harbor, Me. The work is being done in iron conduit and flexible metallic conduit.

THE A. H. BARTH ELECTRIC COMPANY, of Springfield, Ill., recently erected a machine shop which is especially equipped to take care of electrical repair work. The company will carry a complete line of electrical supplies, and is prepared to do wiring of all kinds.

C. H. KELLER, Dubuque, Ia., has opened an office for the transaction of a general electrical contracting and supply business. Mr. Keller has already closed contracts for large motor installation, three large residences, an apartment building and a number of smaller residences.

THE LEHIGH ELECTRIC COMPANY, Allentown, Pa., is installing the lighting system in the store of the C. A. Dorney Furniture Company. Mazda lamps are to be used throughout. The firm also has contracts for the new Jefferson school building, the Dietrich Motor Car Company's new garage and is completing the installation of the power and lighting for the Penn Unit Car Company.

THE ILLINOIS ELECTRIC COMPANY, has opened offices at 308 Twentieth street, Rock Island, Ill., to carry on a general electrical contracting business. Alderman Martin McNealy, who is the chief stockholder of the company, is well known as one of the leading electricians in the Tri-cities. For several years he was connected with one of the telephone companies, and since retiring from that concern he has been doing private contracting work.

H. W. JACOBS, of Santa Rosa, Cal., has been awarded the contract for installing the new lighting system in the business district on Fourth Street. The bid of Mr. Jacobs was $1,025. The new lights will be suspended from graceful brackets on ornamental iron poles, and there will be sixty-four of these iron poles on the street, each holding a two-light electrolier. Mr. Jacobs has promised to have the system in readiness for the coming Rose Carnival.

H. E. LOWE ELECTRIC COMPANY, Macon, Ga., is successor to the Southern Electric Supply and Manufacturing Company, electrical engineers and contractors and also dealers in electrical and combination fixtures, supplies and machinery. H. E. Lowe is president and general manager.

This company has recently taken contracts to wire Mt. de Sales Academy Macon, Ga., cost $1,000; electrical work on the Baptist Church at Vienna, Ga., and electrical work on the Vienna Hotel, Vienna, Ga. B.

Rubber Prices Going Higher.

The United States Rubber Company has announced a general advance of ten per cent in the price of rubber goods of all descriptions. Other manufacturers, as well as wholesalers and retailers, have announced similar advances, some to take effect immediately. Automobile tires, rubber clothing, boots, shoes, bands, surgical accessories and articles of hard rubber are affected.

Explanations offered for the advance in the cost of the crude material vary. Some manufacturers say that it is due to an uneven balance of supply and demand caused by the call for automobile tires. Others blame the rubber boom in London, where prices of crude rubber have risen 200 per cent in two years. Still others say that the market price of rubber has been artificially boosted by manipulators who have obtained practical control of the world's supply.

Col. Samuel P. Colt, president of the United States Rubber Company, said recently that the great increase in the price of crude rubber was due simply to the fact that the supply was not equal to the demand.

"Sixty per cent of the world's output of rubber," he said, "is taken by the United States. One-half of the rubber that comes into this country now goes into automobile tires. This demand is a big factor. Also the fact that the Bank of Brazil has attempted to hold up as much of the crude as possible has had something to do with it. But after all, in my estimation natural conditions would have led to an increase in price before long.

"The only remedy is to increase the supply. To do that we must look not to Brazil but to the far East, to Ceylon, Java, Sumatra and other Straits settlements where labor is cheap.

"Rubber prices can't stay where they are for more than three years. By 1913 the Eastern settlements will be turning out so much crude that the market price will be cut in half. But in the meantime the American manufacturers have no alternative than to raise prices of finished products. They laid in supplies of crude last June, when prices were comparatively low, but these supplies have nearly run out. They have been waiting for a decline in the price of crude, and instead are now facing an increase. The European manufacturers are now in the market for crude, despite the higher prices."

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company for the month of March and nine months ended March 31, compares as follows:

	1910	1909
March gross	$ 95,101	$ 90,497
Expenses	47,490	46,011
March net	$ 47,611	$ 44,486
Nine months' gross	$835,661	$797,638
Expenses	420,828	395,985
Nine months' net	$414,833	$401,653

PHILADELPHIA ELECTRIC.

The Philadelphia Electric Company's report for the year ended December 31, 1909, is issued. The income account compares as follows:

	1909	1908
Gross	$5,489,903	$5,244,963
Expenses, taxes and charges	4,287,642	4,285,301
Surplus	$1,202,261	$ 959,662
Dividends	809,780	711,068
Net surplus	$ 392,480	$ 248,594
Previous surplus	1,391,018	2,141,934
Total surplus	$1,783,498	$2,390,528
Stock dividends	.....	*999,510
Profit and loss surplus	†$1,783,498	$1,391,018

*A stock dividend representing installment on stock credited to stockholders and charged against surplus.
†A stock dividend of $1,500,000 has since been declared from this surplus account.

UNITED RAILWAYS OF BALTIMORE.

The income account of the United Railways of Baltimore for the year ended December 31, 1909, compares as follows:

	1909	1908
Gross	$7,209,983	$6,834,802
Expenses	3,361,871	3,293,338
Net	$3,848,112	$3,541,464
Other income	2,490	3,240
Total income	$3,850,602	$3,544,704
Charges	2,734,187	2,637,182
Surplus	$1,116,415	$ 907,522
Extra expenses	*1,013,413	813,751
Balance	$ 103,001	$ 93,771

*Included in this amount is $456,692 advanced to the treasury for improvements in 1906, and since carried as a deferred assets.

MAHONING AND SHENANGO RAILWAY.

The report of the Mahoning & Shenango Railway and Light Company for the six months ended February 28, 1910, compares as follows:

	1910.	1909.
Six month gross	$1,054,279	$905,158
Expenses and taxes	582,070	562,937
Six months net	$462,209	$342,221
Charges	244,173	233,317
Six months surplus	$218,035	$108,904

INTERBOROUGH RAPID TRANSIT.

The report of the Interborough Rapid Transit Company for nine months of the fiscal year ending March 31 last, shows an increase in gross operating revenue of $2,004,727, and in surplus of $1,403,412. The company carried 417,969,694 passengers, an increase of 39,434,771. Following is the condensed income account:

	1910.	Increase.
Gross operating revenue	$21,530,079	$2,004,727
Operating expenses	8,211,487	120,360
Net operating revenue	$13,318,592	$1,884,367
Taxes	1,272,056	72,197
Income from operation	$12,045,746	$1,956,564
Non-operating income	320,056	*†429,478
Gross income	$12,365,802	$1,527,085
Interest, rentals, etc., including Manhattan guarantee	7,912,715	123,672
Net corporate income	$4,453,087	$1,403,412
Dividends on $35,000,000 Interborough Rapid Transit Co. capital stock for 9 months ended March 31, 1910, at rate of 9 per cent per annum	2,362,500	.....
Surplus	$2,090,587	$1,403,412
Operating per cent	38.14%	3.30%
Passengers carried	417,969,694	39,434,771

*Decrease. †The decrease in non-operating income is largely due to the policy inaugurated July 1, 1909, of not crediting to the income of the company the interest upon the adavances made for the construction of the New York & Long Island Railroad Tunnel.

KINGS COUNTY ELECTRIC LIGHT.

The report of the Kings County Electric Light and Power Company for the month of March and three months ended March 31 compares as follows:

	1910	1909
March gross	$339,008	$295,014
Expenses	163,755	143,653
March net	$175,253	$151,361
Charges, depreciation, etc	203,322	85,146
March surplus	$ 71,931	$ 66,215
Three months' gross	1,071,639	940,852
Expenses	491,760	431,769
Three months' net	$579,879	$509,083
Charges, depreciation, etc	302,649	264,976
Three months' surplus	$277,230	$244,107

AMERICAN TELEPHONE AND TELEGRAPH.

The associated operating companies of the American Telephone and Telegraph Company, not including the long distance lines of the American Telephone and Telegraph Company, have made public a statement covering operations for the two months ended February 28, which shows a substantial gain in gross and net earnings. Following are the figures for the period named:

	1910	Increase
Gross	$26,039,253	$2,704,052
Operating expenses and taxes	9,664,161	707,594
Balance	$16,375,092	$1,996,458
Maintenance and depreciation	8,197,176	1,098,794
Net	$ 8,177,916	$ 897,664
Interest	1,700,530	*396,174
Surplus	$ 6,477,386	$1,293,838

*Decrease.

The unexpended portion of depreciation provision for the two months was $3,449,897, not counted as profits, but remaining as reserve for further replacement.

Nathaniel Thayer has resigned from the directorate of the American Telephone and Telegraph Company and Eugene V. R. Thayer has been elected to fill the vacancy. New members added to the board, increasing the number of directors from eighteen to twenty-five, are Thomas B. Bailey, Harry H. Brigham, George L. Green, Henry L. Higginson, George Willis Perce, Frank E. Warner and Robert Winsor.

The report of the American Telephone and Telegraph Company for the three months ended March 31 gives the following income account:

	1910	1909	Increase
Total revenue	$8,889,351	$7,604,296	$1,285,055
Expenses	781,703	585,937	195,766
Net	$8,107,648	$7,018,359	$1,089,289
Interest	1,284,141	2,221,080	*936,939
Balance	$6,823,506	$4,707,278	$2,026,228
Dividends	5,156,602	3,333,064	1,823,538
Surplus	$1,666,904	$1,464,213	$ 202,691

*Decrease.

Night Letters Becoming More Popular.

The fifty-word night telegrams at the rate of one ten-word day message, with the Western Union Telegraph Company calls "night letters" and the Postal calls "lettergrams," have been in force now about six weeks. Both companies say the public is so well pleased that the arrangement will be made permanent. The experimental stage has been passed.

"One of the most remarkable things," said Belvedere Brooks, general manager of the Western Union, "is that they have caused an increase in the number of standard rate messages sent."

No part of the country has taken to the wire letter more kindly than any other; all sections are using it. A short time ago a man in Winston-Salem, N. C., sent 500 night letters over the Western Union lines in one evening. The Western Union record shows that in the second week of the new rate one Chicago commercial house sent 1,100 night leters in one evening, and in one week two New York business houses sent 4,200 and 4,400 respectively.

By vote of three to two the Appellate Division of the Supreme Court has decided that the Public Service Commission of New York exceeded its powers when it denied an application by the Long Acre Electric Light and Power Company for permission to issue $10,000,000 preferred stock and $50,000,000 bonds.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A New Type of Large Boring Mill.

The sixty-inch motor-driven boring mill shown in the accompanying illustration, is one of a new line of machine tools which embody a number of valuable improvements in design and operation.

This sixty-inch mill has a table sixty-two inches in diameter and takes work forty-six inches high under the cross-rail. Its design has been figured for ample strength to withstand the heaviest cuts with high-speed steels, and has a massive angular bearing which makes the table self-centering under any condition of load or work.

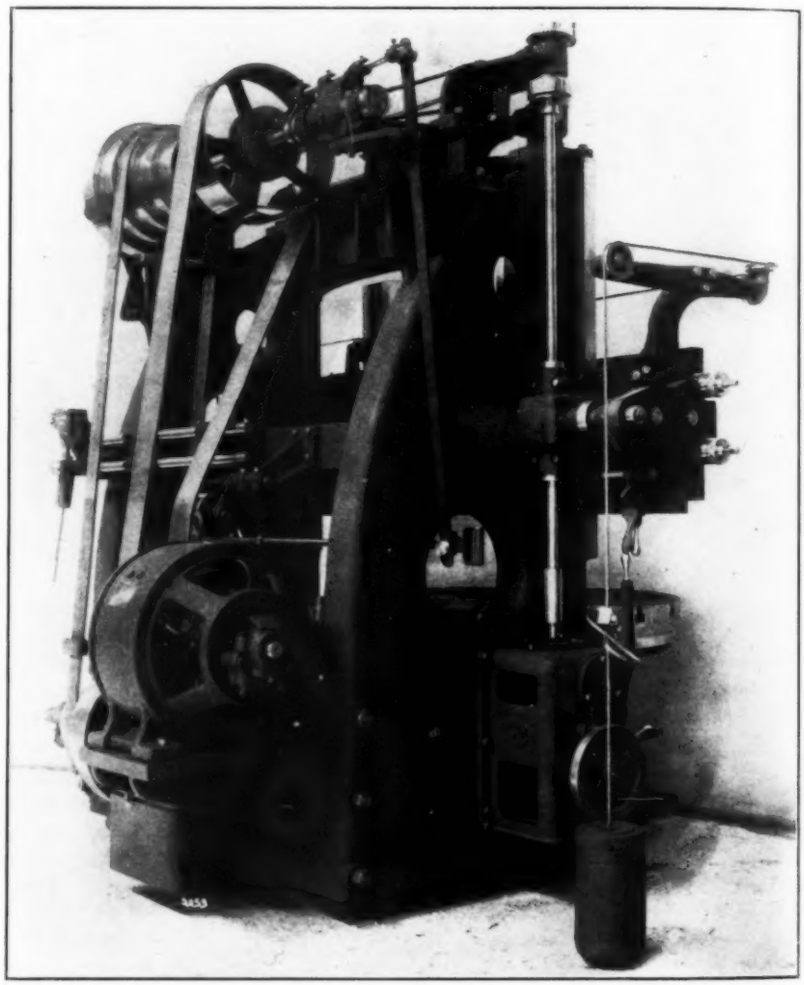
The cross-rail is box-shaped, of massive proportions, and is raised by power independently of the table drive. The heads carrying the tool-holders are entirely independent in their movements, both in the direction and amount of their feed. They can be set for any angles and have a vertical or angular travel of thirty inches. Both heads can be brought to the center of the cross-rail, for boxing. The middle point is accurately marked by a positive stop.

The power rapid reverse feature is furnished regularly on all sixty-inch mills. This device is entirely separate from the regular feeding mechanism, and is driven at constant speed, direct from the countershaft by silent chain. By means of frictions located at the upper ends of the vertical feed shafts, a rapid motion is communicated by power to the feeding mechanism. These frictions can be engaged instantly at any time by simply pulling the rapid traverse lever, located in a convenient position above the feed box. Pulling this lever, automatically disengages the regular feed, and reverses the travel of the tool at a speed of nine and one-half feet per minute horizontally, and six feet per minute vertically and in angular directions. It is impossible for accidents to occur with this device, and no mental effort is required on the part of the operator, as there is but one direction in which to pull the lever, which always returns with the tool over the surface on which it has taken the cut.

The power rapid traverse is a great labor-saving and production-increasing device which entirely eliminates the laborious work of moving the heads by a crank-handle or a wheel.

The safety shear-pin device placed on the rear of each end of the cross-rail, prevents injury to the feed mechanism in case the heads are accidentally run together. A coupling introduced into the vertical-feed-shaft transmits its motion through a small pin, which is arranged to be sheared off in case any abnormal stress occurs in the feed mechanism. Additional pins are furnished, or in case of emergency, a wire nail may be used equally well.

This sixty-inch boring mill is driven by a ten-horsepower motor running at 1,180 revolutions per minute, belted through the countershaft and cone-pulleys to the driving shaft of the mill. A belt-shifter makes the changes from step to step of the cone-pulleys easily and quickly, and without injury to the belt. The friction clutch in the cone pulley countershaft permits the mill to be stopped and started without interfering with the motor.



MOTOR-DRIVEN BORING MILL.

The new line of large boring mills, described and illustrated in the foregoing, and which includes machines built in forty-two, forty-eight, fifty-four, sixty and seventy-two-inch sizes, is manufactured by the Colburn Machine Tool Company, Franklin, Pa.

These machines may be equipped with constant or adjustable-speed Westinghouse motors, if desired.

The Jordan Grip-Hoist.

The Jordan single belt adjustable geared grip-hoist, shown in the accompanying illustration, and being manufactured by Jordan Brothers, Inc., 74 Beekman Street, New York, N. Y., is, on account of its commendable features, being favorably received by the trade.

This hoist is quiet running, is driven by a single belt, no countershaft being necessary and can be successfully operated by electric motor, gas engine, water motor or from a line-shaft. It is designed so that it can readily be installed on ceiling or floor and is furnished assembled and ready to be installed as shown in the cut.

Regarding construction, the material used is said be the best obtainable and this combined with good workmanship makes the hoist strong and durable. The large gear is made of cast iron, machined true and the teeth are carefully cut.

The small gear is made of the best grade of fiber and is securely held in place by a cast-iron flange on one side and a cast-iron flange and bushing on the other, and it is so bored that it can be securely held in its proper place.

The sheave wheels are machined true and, being gear-driven, run at a steady speed. The lever for operating the hoist is secured to the bearing frame and is so arranged that no extra parts are necessary for the lever to operate the sliding bearing, in order to grip the rope between the sheaves.

As the hand rope wears, the sheaves can be brought closer together. The gears can also be adjusted by means of set screws in the bearing frame. If the operating lever is on the wrong side of the grip-hoist it can be reversed to the other side of the bearing frame.

Jordan Brothers manufacture two types of single-belt adjustable geard grip-hoists, No. 1 having a lifting capacity of 2,000 pounds and No. 2 a lifting capacity of 3,000 pounds.

Avenarius Carbolineum for Preserving Wood.

The use of a preservative has almost become a necessity, especially to users of poles and cross-arms, owing to scarcity, increasing demand and consequent higher cost of such lumber. Formerly large quantities of durable, long-lived species of wood were available but now a great deal of short-lived timber must be used, consequently a preservative becomes necessary for increasing its lasting qualities.

In this connection attention is called to Avenarius Carbolineum, a wood preservative invented by R. Avenarius, a chemist of Germany, about forty years ago. This preparation is a finished, insoluble chemical compound, a thin, oily substance of heavy specific gravity and a disinfectant. It contains all known preserving elements, eliminating their objectional features.

The chemical ingredients of this preservative will gradually permeate and cure the wood, making it tough and increasing its holding power of spike or nail. The heavy oily ingredients of this preparation secure self-impregnation, but they do not close the wood pores, although they repel water, thus permitting circulation of air and preventing the dry-rot of the wood.

Avenarius Carbolineum is shipped ready for use. It does not deteriorate, evaporate, nor contain volatile ingredients, therefore can be kept on hand without loss, depreciation or danger. Another advantage claimed for this preparation is that it is a non-conductor of electricity. It is applied with a brush and in frequent cases takes the place of paint as it stains the wood a deep nut-brown color.

The Carbolineum Wood Preserving Company, Milwaukee, Wis., is the sole agent for the United States, Mexico and Canada.

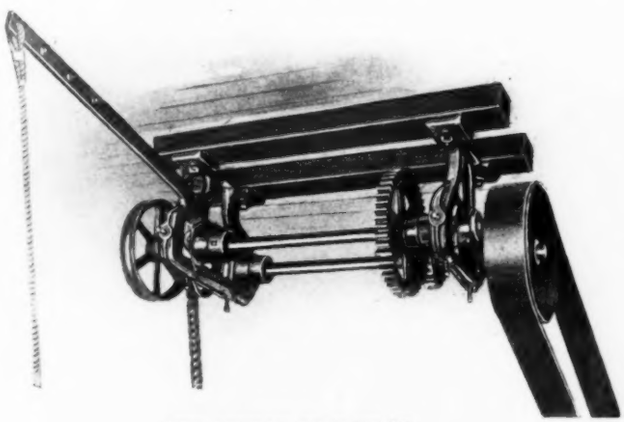
Battery Charging Sets.

There are certain cases where electric power is desired and the electricity of the power circuit cannot be applied directly, as in the case of charging storage batteries from an alternating current source. To meet the requirements of this service the General Electric Company manufactures the motor-generator set shown in the accompanying illustration.

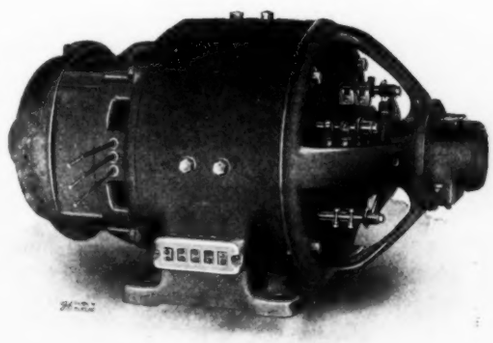
The generator voltage may be varied between 60 and 125 volts by means of a controlling rheostat which is a part of the equipment of this battery charging set.

To meet all conditions of installation the generator may be driven by a direct current motor designed for 230 or 550 volts; by a polyphase alternating current motor designed for 110, 220, 440 or 550 volts, sixty cycles; or by a single phase alternating current motor designed for 110 or 220 volts, sixty cycles.

The set described may be mounted on the floor, wall or ceiling which ever way may be most convenient or occupy the least valuable space.



THE JORDAN GRIP-HOIST.



BATTERY CHARGING SET.

A NEW SYSTEM OF FUSES.

SIEGFRIED HELD.

As a result of the endeavors of the "Verband Deutscher Electrotechniker" and the "Vereinigung der Elektrizitatswerke," a number of improvements have been brought about in the way

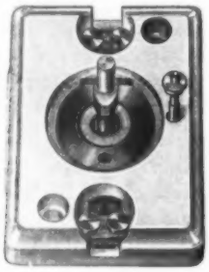


FIG. 1.

of perfecting fuses and making them non-interchangeable. Several factories have adopted the suggestions of these societies and are producing non-interchangeable fuses. Among these new fuses is the type "M" fuse, so called after its inventor, Werner Menzel, which is described here.

The type "M" fuse is not based on old designs, and it may, indeed, be said to be something entirely new. The four principle pieces of the type "M" fuse are as follows:

1. A porcelain base with a contact and a terminal screw in the center (Fig. 1).
2. A protective cover with ring adjustment (Fig. 2).
3. Cartridges, which vary according to the strength of the current (Fig. 3).
4. A cover (Fig. 4).

FIG. 2.

The porcelain cover has a ring contact, which was tested for many years and was found to be perfectly satisfactory. In the center of the base is a fixed central contact (Fig. 1), which is made in one piece of brass. Near the top and just where the thread for the cover, commences the terminal has an elliptical shoulder with the largest dimension parallel to the longest side of the base. The shoulder fits accurately into a similarly shaped hole inside the cartridge (Fig. 3).

On the right hand side of the central contact is a screw with nut which may be sealed after being made fast. The protective cover is made of paper mache in the usual shape. There is a metal bushed hole on one side for the screw (Fig. 5). The adjusting ring (Fig. 6) has nine holes at equal distances, numbered 0, 2, 4, 6, 10, 15, 20, 30 40 corresponding to the normal sizes of cartridges used. At 0 there is a slot on the inner circumference for the projection on the cartridge. The ring has three lugs by means of which it is

FIG. 3.

FIG 4.

clamped to the cover in such a manner that it can easily be turned by hand.

As may be seen by reference to Fig. 3 the projecting lug on each size of fuse is in a different place with reference to the axes of the elliptical slot, so that when the base has been set for a certain size of fuse it is impossible to insert a fuse of another size unless the seal be broken and the adjustment changed. The fuse, after being put in place, is protected by the screw-cap shown in Fig. 4, so that the fuse put in place appears as Fig. 7.

FIG. 5.

This fuse is manufactured by O. W. Kehrs, Dusseldorf, Germany, and the patent rights are for sale by Dr. Wm. Held, 1111 West Chicago Ave., Chicago.

FIG. 6.

Electric Drive in an Emergency.

The recent explosion of the boilers of the Pabst Brewing Company at Milwaukee, Wis., and the quick resumption of work enabled by securing electric power from an outside source, strikingly shows one more advantage which electric motor drive has over forms.

In this explosion four of the eight 400-horsepower boilers were completely wrecked, and the entire steam plant was out of commission for several days. Hence it was imperative that power be secured from some outside source. To fill this demand, the Milwaukee Electric Railway and Power Company was called upon for a delivery of 600 kilowatts to be commenced in shortest possible time. Three transformers, to reduce the voltage from 13,200 to 440 volts, were in place a few hours after the explosion, and by midnight of the same day current was being supplied to all the needed motors.

The brewing plant is electrically operated throughout; it employs nearly 150 Westinghouse three-phase, twenty-five-cycle, induction motors ranging in capacity from one-half to fifty horsepower, and totaling nearly 2,000 horsepower rated capacity. That the motor equipment was so complete proved very fortunate at the time of the disaster, for, by means of the connection which was made with the central station, the work in practically all departments was resumed at once. Thousands of bushels of grain in progress through the different stages of brewing were saved from spoiling, and 300 people were enabled to work on continuously.

FIG. 7.

Protecting Series Street Lighting Circuits.

The necessity of a device for protecting series street lighting circuits in case any portion becomes ruptured has caused many attempts to be made to produce a device which will be both commercial and reliable. Open circuits in street lighting systems not only result in interrupted service, but are also a source of danger. Moreover, in cases where outages are penalized by a municipality, such interruptions entail a loss of revenue to the central station.

To meet the conditions imposed by commercial requirements the device illustrated herewith has been developed by the Delta-Star Electric Company, Chicago, Ill., as a solution of what has been a very troublesome problem to

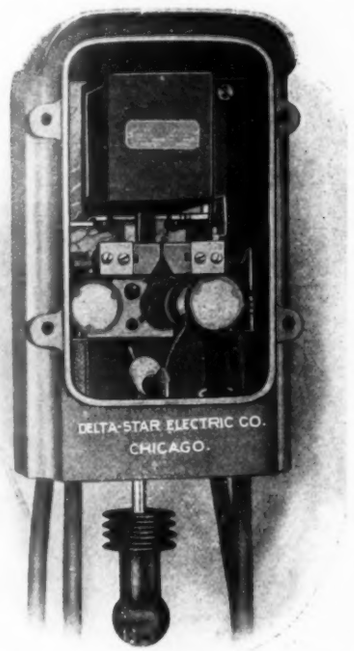


FIG. 1.—WEATHERPROOF POLE-TYPE CUT-OUT WITH COVER REMOVED.

central-station managers desiring to give the best possible street lighting service.

Fig. 1 illustrates the general construction and assembly of the device, the weatherproof cover having been removed to permit a clear view of the various elements. A single magnetic circuit control magnet provided with a movable core is so arranged as to actuate a pair of laminated copper brushes normally held by gravity against two stationary contacts to which the lamp circuit to be protected is connected. By means of heavy porcelain insulators the movable brushes are thoroughly insulated from each other and in turn the stationary contacts are insulated from each other and ground. To each stationary contact is soldered a heavy lead carried through porcelain bushings mounted in a retaining case and so arranged as to be connected to that loop of the lamp circuit which is to be protected. To each laminated brush is secured a flexible lead incased in porcelain bushings and through suitable connections is attached to the main line from the generating station.

A pair of adjustable carbons mounted on insulators form a spark gap in series with the control magnet and shunted across the main lamp circuit. One carbon is permanently connected to one side of the line and the other in addition to this permanent condition to the opposite side of the line. The latter carbon is connected to an auxiliary fixed contact and a movable contact actuated by an insulated handle. It will be noted that the latter contact is of such contour as to fit the V-shaped portion of the carbon spark gap.

The connections may be understood from the diagrammatic sketch shown in Fig. 2. The circuit under normal conditions starts from the terminal T of a constant-current generator or transformer, passes through the series lamps LL, through the flexible lead J to the laminated contacts B and to the fixed contact C. From this point it continues through the series lamps N (circuit to be protected) to the fixed contact C^1, movable contact B^1, flexible lead J^1 and back to T^1 the opposite side of the source of supply.

Assuming a break occurs at O in the protected section extending from C to C^1, it will readily be seen that the full potential difference of the line will exist between the adjacent points of the gap formed by the carbon plates E, E^1. The spacing of this air gap is such that the potential will immediately break across and an instantaneous current will flow from the generator or transformer terminal T through the series lamps L, across gap G, through the control magnets and to the point Q. At this point a single lamp M is inserted between Q and R, thus completing the circuit through the remainder of the series lamps to the opposite side of the generator or transformer T^1.

The conditions outlined above will continue but a fraction of a second as the current flowing through the control magnet S energizes the movable core A causing it to be immediately drawn up carrying with it the insulating porcelain P and brushes B B^1, thus opening the lamp circuit N at the fixed contacts C C^1. The upward movement of the switching element causes the brush B to make connection with the fixed contact D, thus short-circuiting gap G and the fixed contact C C^1. The circuit is thus continued through the control magnet S and the signal lamp M which remains lighted as long as the magnet is energized, thus giving visual indication of trouble in the protected loop.

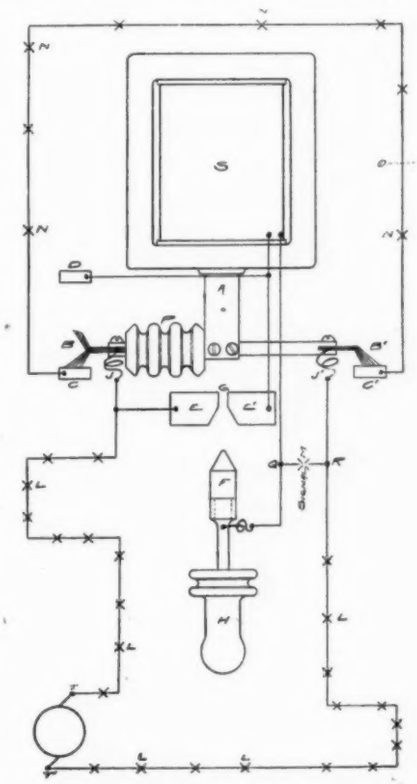


FIG. 2.—INTERNAL AND LINE CONNECTIONS.

Where this lamp indication is not desired the lamp may be omitted and permanent connection made between the points Q and R.

If, to meet local conditions, it is deemed advisable that the signal lamp M be made one of the regular lamps of the circuit this can be accomplished by permanently connecting together Q and R and placing the lamp between R and J^1, under which condition it will always remain lighted except when trouble exists in the protected loop, such trouble then being indicated by extinguishing of the lamp.

After the break in the line at *O* has been reported the lamp circuit *N* is still dead and can only be restored by pushing up the handle *H* which brings *F* in contact with the carbon arcing pieces *E* E^1, thus short-circuiting the control magnet *S*. Demagnetization of the core is thus effected and the plunger *A* falls by gravity, bringing the moving brushes *B* B^1 into contact with *C* C^1. Withdrawal of *F* therefore restores the circuit previously cut out and its re-establishment is indicated by extinguishing the signal lamp *M* (unless connected as noted above, in which case the conditions will be reversed).

If, however, the circuit has not been properly repaired, or a second break has occurred, withdrawal of *F* will cause the arc to be re-established across the gap *G*. The control magnet will be re-energized and the defective line again cut out in the same manner as above. This procedure will continue until the defective circuit is properly closed as it is impossible for any other condition to exist with the arrangement shown.

The device consumes no energy whatever except when trouble exists in that part of the circuit containing the lamps *N L*; moreover, the main contacts do not make or break any current when the cut out operates.

A few of the commercial advantages of the new method of protecting high-tension lighting circuits may be summarized as follows: Prevention of outages and accidents, automatic location of faults, automatic disconnection of ruptured circuits, effects considerable saving in wire, reduces number of station regulators and switchboards, enables use of longer lamp circuits, reduces legal claims.

New Plant for Niagara Falls.

The United States Light and Heating Company has awarded Snyder & Gillette, of Niagara Falls, the contract for erecting a very large new plant in that city. The site selected comprises twenty acres at the north end of the city adjoining the plant of the Carter-Crume Company. The sixteen buildings to be put up will cover about ten acres of the land so selected, the expectation being that the new industry will be the largest yet captured by Niagara Falls. The buildings will call for an expenditure of over $300,000, exclusive of equipment. Power will be supplied by the Niagara Falls Hydraulic Power & Manufacturing Company, the understanding being that the contract is for 1,000 horsepower, which will be transmitted to the plant from the power house in the gorge.

Brick, lumber and concrete will be the materials used in the construction work. Ground was broken on April 22, and the work will be rushed with all possible speed in order to have some of the buildings ready for occupancy by fall. The sprinkler system will be installed by the American Sprinkler Company of New York, and the heating system by the Harrison Engineering Company, also of New York.

The officers of the United States Light and Heating Company are: President, W. H. Silverthorne; vice-presidents, Julius H. French, Edwin Hawley, C. A. Starbuck and J. Allen Smith; secretary-treasurer, W. S. Crandall. The company was incorporated under the Maine law in January, 1909, and is a merger of the National Battery Company of Buffalo, the Bliss Car-Lighting Company of Milwaukee, and the United States Light and Heating Company of New Jersey, all of which interests will be consolidated in the big new Niagara plant. It is expected that the plant will employ from 1,500 to 3,000 hands. The company makes axle-driven generators for mounting under railroad cars, driven by belt from axle pulleys for generating current to be employed in lighting, heating and ventilating cars. Quite a number of railroads have already adopted the system, while other roads are waiting to install it. The company also makes the necessary switchboard and controlling apparatus.

The company located in Niagara Falls as a result of the efforts of Arthur Schoellkopf, of the Niagara Falls Hydraulic Power and Manufacturing Company, who had been working hard for more than a year to land it for the city in the upbuilding of which he is particularly interested. The factory site has excellent railroad connections and business will be handled with efficiency. Of late many industries have come to recognize the north end of Niagara Falls as a most advantageous factory location, and this new industry has aroused new hope in Niagara's future.

The Lord Manufacturing Company.

The Lord Manufacturing Company of New York, in a letter which it has mailed to its customers throughout the United States, Mexico, South America, Great Britain and Japan, announces its incorporation as a separate company. This step was made necessary by the increasing business of the manufacturing department of the Lord Electric Company and large number of devices that were being manufactured and sold by it. No specialties had ever been taken without a careful investigation being made, and as a result of this policy a number of carefully tried articles have been added to the original line of lightning arresters and rail bonds. At the present time the company handles trolley retrievers, trolley catchers, and an intermediate device which semi-retrieves, choke coils, hydrogrounds, and lightning arrester accessories, controller regulators, Bradshaw car skids and a line of arc lamps.

While the Lord Manufacturing Company is independent, it is intimately associated with the Lord Electric Company and the Lord Construction Company and contracts formerly made with the manufacturing department of the Lord Electric Company will be carried out by the Lord Manufacturing Company. The new manufacturing company has taken some of the largest contracts ever placed in the United States, for the specialties manufactured by it.

Investigations on Street Lighting.

V. R. Lansingh, general manager of the Holophane Company, gave an address on April 20 before the Technology Club of Syracuse, New York, his subject being "Investigations of Fundamental Requirements of Street Lighting."

Various members of the Holophane Company's staff for many months have been giving very close study to this subject with view to developing more efficient and satisfactory street lighting equipment. Before endeavoring to work out the results of these investigations, however, the technical questions involved have been submitted in the form of papers to various technical and scientific bodies. Mr. Lansingh's appearance before the Technology Club is only one instance, another being a paper recently delivered by A. J. Sweet before the Franklin Institute of Philadelphia.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, APRIL 16.—Since the opening of the experimental trackless trolley line near London last year, little has been heard of this system of electric traction, mainly because no municipality had parliamentary powers to adopt it, and no tramway company seems disposed to do so. The subject has been revived this week, however, by applications to Parliament for powers to adopt the system and spend money upon it, by the Leeds and Bradford corporations. The idea in both cases is to install trackless lines as feeders for districts away from the tram routes and where at present it would not pay to construct tramways. A considerable saving in running costs is not claimed for the system, but the case in favor of the scheme is a saving of twenty-five per cent in capital cost. In view of the failure of motor omnibuses to successfully serve the purpose of feeders, the advent of the trolley omnibus in this connection would seem to be the only alternative. So far as the municipalities are concerned, the system would undoubtedly have been in opration ere this, but for the necessity of obtaining parliamentary powers.

Electric power companies have been severely handicapped in Great Britain owing to the fact that almost any corporation owning an electricity undertaking has always been able to prevent a company supplying in their district, even though they could admittedly supply much cheaper. This is to a very large extent responsible for the poor position of the power companies today, most of them having been forced to operate in very scattered and "lean" areas. The Lancashire Electric Power Company, however, has at last determined to make a big effort to improve the condition of affairs, for it has taken the bold course of applying to the Board of Trade for permission to compete with the corporation in Radcliffe, upon the borders of which town their power station has been erected. Should the company be successful in this, they will set a very valuable precedent for similar proceedings in other towns, both in their own area and the areas of other companies.

The question of the commercial management of municipal undertakings is always with us, and opinions remain as inconsistent as ever. The admission was made at the last meeting of the Birkenhead corporation that although many thousands of pounds have been paid over by the Tramways and Electricity Committees to the relief of rates, yet no provision has been made for depreciation. Further, it was blandly stated that when the need for depreciation arrives, it will have to be met out of rates. Of interest in this connection is a bill of the Glasgow corporation in which Parliamentary powers were sought to pay a portion of the profits of the gas undertaking to the relief of rates, but the proposal was rejected. On the same matter, a difference of opinion has arisen at Dublin, where the Finance Committee has to meet a huge deficit on the corporation electricity undertaking. It is proposed to do this by a somewhat heavy levy on the rates, but exception has been taken to the legality of this course, on the ground that the electric light charges are considerably below the maximum which the Electricity Committee are entitled to charge. The point has not yet been settled.

The Poplar Borough council has installed a second plant for the manufacture of electrolytic disinfectant. The first plant has been working for several years, with satisfactory results from the point of view both of efficiency and economy.

Information has been received by the Engineering Standards Committee that the government has decided to assist them financially during the next three years to the extent of $2,500 per annum. The Indian government has also made a frank of $1,500 on account of special researches relating to India.

A company has been formed to undertake the provision of electric supply in a large number of rural districts with comparatively small populations. The main idea underlying the scheme is to reduce expense by dispensing with all Parliamentary powers and erect works and adopt overhead wires universally under agreements with the local authorities. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, APRIL 14.—Among the new lighting and power projects in France I note that the municipal council of Troyes is considering the question of installing a power and electric heating system. The concession will probably be granted to a Paris company. The hydraulic plants of Portcharra and Cemon are to be called upon for an electric lighting supply for the town of Montalian, in the Savoie region, and the contract is to be awarded to the Greswaudan company. The three-phase 10,000-volt system is to be employed here, with a series of transformer stations. A co-operative plan is under consideration for the town of Bedarieux, and it is likely that a hydraulic plant will be built for the purpose in the neighborhood.

At a recent meeting of the Société des Electriciens at Paris, M. Alexandre Tosi presented an interesting paper upon the new wireless station which is erected at Boulogne, on the Channel coast of France, by the French Government. It is designed to use the Bellini-Tosi method of directed waves, and during the tests which were made, the results were very gratifying.

At Baku, Russia, it has been decided to adopt electric traction for the various sections of line in order to replace animal traction, and the city is to purchase the present lines so as to be able to make the change. A concession will then be granted for installing and operating the new lines and also for the extension of these latter. Such rights will be given either to a Russian or an outside company. At the same time the question of electric lighting will be considered. It is stated that a telephone line of some length will be run from the town of Theodosia as far as Kertsch and Sondak.

A hydraulic plant is to be erected in Bosnia in the neighborhood of Sarajevo, in order to secure current for the new electric railroad which is to be built between Sarajevo and the town of Didze. The hydraulic station is to be built on the Zeljesnica River.

The Rhenish-Westphalian electric construction works has lately secured the contract for building a light railway from Cleves to Emmerich, Germany and also for the electric lighting of these localities. At Klagenfurt, Austria, there is to be installed a tramway line and the construction is to be carried out by the Vienna Siemens-Schuckert works. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., APRIL 23.—The Montreal Street Railway Company has announced an unsolicited increase of one cent per hour in the pay of the 3,000 conductors and motormen in its employ. The increase makes the minimum rate nineteen cents per hour and the maximum twenty-one cents, the latter rate also carrying free uniforms.

A party of financiers which inspected the plant of the Shawinigan Power Company at Shawinigan Falls, Que., this week, was greatly impressed with the property. This property will, when present plans are completed, be one of the biggest power properties in America. The company has extensive plans for expansion under way, and will soon be in a position to develop added power at an exceptionally low rate.

The consumption of coal in the Cobalt silver mining camp will fall off fifty per cent, it is estimated, owing to the arrival of cheap electricity and air. As there were 104,416 tons of coal imported last year, at a cost to the mines of $5.50 per ton, it means that $290,300 less fuel will be brought into the camp on delivery of electricity from Ragged Chutes, Hound Chutes and the Matabitchouan, and compressed air from the Mines Power Company. All the coal for the camp is imported from the United States, and the cost of the freight and the duty is more than the original price of the coal at the pits' mouth.

Messages for transmission via land lines and wireless, between Montreal and any point in Great Britain and Ireland, are now accepted at a rate of twelve cents a word, including all charges. This rate applies to messages written in English, and commercial messages in code will be accepted at fifteen cents a word. Press messages will be sent at seven cents a word. These rates are based on a minimum of ten words.

H. G. Mathews, manager of the Marconi company, says that the high power stations at Clifden, on the west coast of Ireland, and Glace Bay, Nova Scotia, are practically completed; in fact, they are now working for test purposes. By means of these stations it will be possible to maintain a wireless service over a distance of 2,100 miles, by all means the greatest distance over which commercial messages have been despatched. Mr. Marconi is now at Glace Bay superintending the work. It is expected that within three months the service will have developed to such an extent that 20,000 words will be handled between the two coast stations during each twenty-four hours. W.

MEXICO.

(Special Correspondence.)

MEXICO CITY, MEXICO.—In line with its policy of encouraging railroad building in this state, the government of Durango has granted a concession to Francisco Neugebaurer for the construction of an electric or steam line from Tepehuanes to the Guanacevi mining district. The state government guarantees for a period of

twenty-five years, six per cent per annum on the amount of money that may be invested by the company which Mr. Neugebaurer in constructing the line. The government will also donate the right of way and depot and terminal grounds. It is specially stipulated that in case the earnings of the road do not amount to six per cent the state government will make up the deficiency. The proposed road will connect with the international division of the National Railways of Mexico at Tepehuanes. It will be about fifty miles long and will penetrate a very rich mining district that is now remotely situated from railway transportation facilities. An investigation is being made by Mr. Neugebaurer of the relative cost of installing electric equipment for operating the proposed road and that of operating it by steam. It is thought that an available site for a large hydroelectric plant for providing power for the road is case electric transit is adopted may be found in the mountains adjacent to the line. The headquarters of the road will be in Durango. The concession also authorizes the construction of telephone and telegraph lines along the route of the road.

The Monterey Railway, Light and Power Company has merged the two plants which formerly furnished the power for the street railway system and the lighting of the city into one central plant. It has already installed two steam turbine generators, each of 1,000 horsepower, and will install two more of the same capacity. The company will make other important improvements to its railway, light and power system, including extensions of its electric railway lines to suburban points. The company is composed of Toronto, Canada, men.

Governor Enrique C. Creel, acting on behalf of the state of Chihuahua, has just granted to the Mexican Securities Corporation, Ltd., of Halifax, Nova Scotia, a concession for the establishment of ten electric lighting and power systems. It is regarded as one of the most valuable concessions ever granted in Chihuahua, as it gives that company the exclusive right to install and operate its plants in the towns of Santa Barbara, Villa Escobedo, Zaragoza, Sancillo, San Francisco de Conchos, Rosales, Naica, Meoqui, Aldana and Santa Eulalia. The Mexican Securities Corporation, Ltd., is closely allied with the Mexican Northern Power Company, the Canadian concern, which is constructing a great dam and hydroelectric plant on the Conchos river, seventeen miles from Santa Rosalia, under a concession granted by the government of this state. It is stated that the latter company will build transmission lines to all of the towns embraced in the concession that has just been granted to the Mexican Securities Corporation, Ltd., and that it will provide the electrical energy for operating the different substations. D.

LIGHTING AND POWER.

(Special Correspondence.)

LIDGERWOOD, N. D.—It has been decided to install a complete street lighting system. C.

BENTON, ARK.—The Benton Electric Light Company is about to build a power house.

TROY, KAS.—This city has voted bonds for the construction of an electric light plant.

PROVO, UTAH—This city will soon vote on electric light and waterworks bonds to the amount of $188,000.

CORNING, ARK.—The Southern Ice and Power Company has been incorporated with a capital stock of $10,000.

FALLON, NEV.—J. P. Daniel, of Wonder, Nev., will establish an electric power plant near here to cost $50,000.

TYNDALL, S. D.—The council is planning the installation of a municipal eletric light system at a cost of $20,000. C.

ANOKA, MINN.—This city is about to issue $60,000 of electric light bonds, for main power plant, sub-stations, etc.

FORT WORTH, TEX.—The Multi Electric Manufacturing Company is about to install an electric motor plant here.

LA CROSSE, WIS.—The council declines to go on record as favoring a bond issue of $50,000 for a municipal lighting plant in this city. C.

FORNEY, TEX.—The Forney Electric Company has been incorporated with a capital of $10,000, by Yancey McKellar and others. P.

THORNDALE, TEX.—Messrs. Ziescang & Johnson will install an electric light plant here. They already have a private plant for their own use. D.

ILWACO, WASH.—The North Shore Light and Power Company has been incorporated by F. M. Eidson, E. L. and C. E. Houston, with a capital stock of $25,000. A.

SEATTLE, WASH.—The Nespelem Falls Power Company has been incorporated by J. B. Callahan, Wm. Kingley and John Arthur, with a capital stock of $500,000. A.

SEATTLE, WASH.—The Bothell Electric Company has been incorporated by C. W. Kimball, W. A. Garlick and A. R. Rutherford, with a capital stock of $25,000. A.

SEATTLE, WASH.—The Berlin Power Company has been incorporated by R. C. Burtrand, F. L. Forbes, J. H. Henley, W. H. Bruckart, with a capital stock of $500,000. A.

FARIBAULT, MINN.—The Consumers Power Company has taken over the plant of the Faribault Gas and Electric Company and will improve and extend the service. C.

HAYWARDS, COL.—D. U. Toffelmier, president of the People's Light and Power Company, announces that work on a power line from Fruitville to Haywards will begin early in May. A.

GUADALAJARA, MEXICO.—Manuel R. Uruchurto will install a hydroelectric plant on the Tequila River in this state. He has applied to the federal government for a concession for the proposed enterprise. D.

ALVARADO, STATE OF VERA CRUZ, MEXICO.—The city council of Alvarado has entered into a contract with the firm of Lara & Leal, of Mexico City, for the installation of an electric light plant here. D.

BLUFFS, ILL.—The Bluffs Electric Light, Power and Heating Company has been incorporated with a capital stock of $5,000. The incorporators are Fred C. Brockhouse, John D. Brockhouse and F. C. Funk.

BAKERSFIELD, CAL.—H. A. Stantion has applied for a thirty-year franchise to erect poles and stretch wires for transmitting electricity for light and power along certain streets in the town of McKittrick. A.

CHIPPEWA FALLS, WIS.—The Davis Falls Land Company has let the contract for the construction of a dam at Davis Falls, formerly Jim Falls, on the Chippewa River, to Ule & Company, of Grand Rapids. The structure will cost about $70,000. M.

WASHBURN, N. D.—The North Dakota Heat and Power Company is building at Energy, twenty-five miles north of here, a power plant to develop 25,000-horsepower, and it proposes to run a power transmission line to Valley City, via Carrington. C.

INDIANAPOLIS, IND.—The posts and three globe lights now being installed by the Merchants Heat and Light Company as a part of a general lighting plan in the business destrict, are greatly admired and commended for their uniformity and brilliancy. S.

IRONDALE, WASH.—Under the direction of W. A. Marsden, the Seattle Electric Company has begun the installation of the machinery for the electric plant of the Western Steel Corporation. The plant will be of 500-horsepower. It will furnish power and light the town.

GOLDFIELD, NEV.—Judge Van Fleet, of the United States Circuit Court, has appointed Attorney Macnichol as receiver of the Blue Light Copper Company of Goldfield, which is to be sold to satisfy a judgment of $150,000 held by the Central Trust Company of Indianapolis.

CONNERSVILLE, IND.—The stockholders of the Connersville Light, Heat and Power Company have increased the capital stock from $100,000 to $300,000. The increased capital will be used in remodeling, improving and enlarging the plant and adding some modern machinery. S.

CARSON, NEV.—Machinery for the power plants to be built in Mono County has arrived from the East. A number of small creeks and a chain of lakes will be used to develop power, which will be distributed in Tonopah, Goldfield, Mina, Rawhide and other camps in Southern Nevada. A.

SCATTSBURG, IND.—The town board has decided to install an electric lighting system and is in the market for poles, wire and lighting fixtures. The town has contracted with the Indianapolis & Louisville Traction Company for current at three cents a kilowatt hour. The series Tungsten system of lighting will be used.

KITTANING, PA.—The powerhouse of the Kittaning Electric Light Company and the Kittaning and Leechburg Street Railways Company, a brick building covering an entire block, was destroyed by fire a short time ago. Its contents, including much valuable machinery, were practically turned into junk. The loss is estimated at $200,000.

DADEVILLE, ALA.—It is stated that the Russell Manufacturing Company, Alexander City, Ala., is negotiating with John W. Pace for the purchase of waterpower on Big Sandy Creek, nine miles from Dadeville, and that if purchased, the power would be developed and transmitted electrically to Alexander City, a distance of eleven miles. B.

SULLIVAN, IND.—The Sullivan Electric Company has asked the city council for an extension of its contract for lighting the streets at $60 a year per light. If this extension is granted the company will obligate itself to install about $3,000 worth of new machinery at once. It is also asking for a change to the meter basis of charge for incandescent lights. S.

SAN FRANCISCO, CAL.—H. H. Noble, president of the Northern California Power Company, will, this spring, close contracts for the electrical equipment of the new power developments at Horseshoe Bend, on Battle Creek. The three 4,000-kilowatt units which will be installed will increase the capacity of the Northern California Power Company's five systems to 42,000 horsepower.

CHEHALIS, WASH.—The Twin City Light and Traction Company has closed a deal with the Coal Creek Lumber Company, of Chehalis, for the erection of its new $75,000 powerhouse on the mill site in the north end of town. The traction company expects

to install turbine engines, and use slab wood from the mill for fuel in future. The coal mine, near by, will be available for emergency uses.

BROWNSTOWN, IND.—The Brownstown Water and Light Company has been incorporated with a capital stock of $50,000. The company proposes to build, equip and operate a combined plant to furnish the citizens with water and electricity or either of them. The company is in the market for material and expert labor. The directors are: Harley Jackson, G. S. Gray and D. B. Vance. S.

INDIANAPOLIS, IND.—Dewitt V. Moore, of this city, a vice-president of the International Engineering Company of New York is planning to establish a western office for the company in Indianapolis. The company has a capital of $500,000 and has on its books contracts for construction work amounting to about $12,000,000. It is regarded as one of the greatest engineering companies in the world. The company specializes largely in the construction and equipment of steam and electric railways and lighting plants.

WAUKESHA, WIS.—The Waukesha Lime and Cement Company is adding considerable equipment to its plant here and has recently placed an order with Allis-Chalmers Company for both crushing and electrical apparatus. This includes one No. 12 style "K" Gates breaker, two No. 9, style "B" Gates elevators, one with forty-three-inch centers and one with seventy-two-inch centers, and four 400-volt, three-phase, sixty-cycle, squirrel-cage induction motors varying in size from thirty horsepower to 150 horsepower.

DWIGHT, ILL.—Selgert Bros., who for many years have conducted the electric lighting plant in Dwight and also controlled the franchise for the same have sold it to the Economy Light and Power Company of Joliet. The new company expects to run a line into Dwight from its Joliet plant. It already has secured plants in Braceville, Coal City, Wilmington, Streator and expects to secure plants at Odell and Cornell. The company is erecting a mammoth plant at Dresden Heights which is to be operated by waterpower, and from this it expects to supply territory for miles in every direction.

ALLENTOWN, PA.—The Allentown Electric Light and Power Company has closed a contract with the Central Railroad Company, of New Jersey, for the complete lighting of its enlarged yards between Allentown and Bethlehem by means of arc lamps and is now proceeding with this work with a large force of men. The electric light company has also closed a contract with the railroad company for the power required to operate a new interlocking plant at the West End terminal, where it connects with the Terminal railroad. The electric light company will also supply power to the Lehigh Valley Structural Steel Company for the operation of its machinery.

ELECTRIC RAILWAYS.

(Special Correspondence.)

SAN DIEGO, CAL.—The San Diego Electric Railway Company is about to build, along Grand Avenue, an extension to be known as the K Street line, ten miles in length. A.

NORTH BEND, ORE.—The Coos Bay Rapid Transit Company has been incorporated by L. D. Kinney, G. M. Everett, G. W. Kitchen and others of North Bend, with a capital stock of $1,000,000. A.

LYNNVILLE, IND.—The business men of this place are organizing a company to build an interurban line from Lynnville to Booneville, a distance of ten miles. Lynnville is an inland town considerable wealth. S.

STOCKTON, CAL.—The Central California Traction Company, now operating an electric line to Lodi and building one to Sacramento, has under consideration the construction of a line to Lockeford, which is about twelve miles northeast to Stockton.

DELPHI, IND.—Robert Ward, representing an interurban company, is asking the commissioners of Carroll and Clinton Counties a franchise right to construct and operate a traction line from Logansport to Frankfort through Carroll and Clinton counties. S.

RIVERSIDE, CAL.—J. B. Jackson has applied for a trolley line franchise to connect the towns of Moreno, Lakeview, San Jacinto, Hemet and Florida and extend up to the foot of the grade in the San Jacinto Mountains. The proposed road is to be twenty-five miles long. A.

PORTLAND, ORE.—The Fairdale, Trask and Tillamook Railway Company has been incorporated by R. Hawkins, J. M. Gearin and A. B. Wastell, with a capital stock of $10,000. The purpose of the company is to build a line from Fairdale, Yamhill County, to Tillamook. A.

INDIANAPOLIS, IND.—A company of prominent citizens of this city and of New Castle made a trip April 7 over the new New Castle traction line and inspected it. The line has been substantially built and the machinery is all of a modern type. The new line will be opened for traffic May 1. S.

AUGUSTA, MAINE—The Kansas Railway and Light Company, with J. H. McLellan, Portland, president, and Edward Woodman, Portland, as treasurer, was organized at Portland for the purpose of constructing, owning and operating railway, telephone and telegraph lines, electric lighting plants, etc., with a capital stock of $1,500,000.

MILFORD, IND.—Omer E. Neff and associates are projecting an elctric line from Bremen to Mishawaka by way of Milford, Woodland, Wyatt and Coalbush. The line would pass through a rich farming country and afford transportation to a number of towns void of rail transportation. Mr. Neff says plans are sufficiently advanced to assure the commencing of work in a few weeks. S.

HAMMOND, IND.—By the granting of a franchise to the Eastern Illinois Traction Company in West Hammond, April 8, Hammond has been made the interurban gateway into Illinois, and one of the most important interurban railway centers in the middle west. When new interurbans about to be built are added to those already in operation, fourteen electric railways will focus in this city and connect with Illinois and Indiana systems.

SOUTH BEND, IND.—Practically every interurban road in northern Indiana will make important improvements this summer. These roads include the Northern Indiana, the South Shore, the Southern Michigan and the Air Line, which will be extended from Laporte to Chesterton and Valparaiso. Within the next month for a franchise right to construct and operate a traction line from work will be started on a line connecting Hammond with Joliet, Illinois. S.

HOUSTON, TEX.—A syndicate of Detroit, Mich., men is preparing to construct an interurban electric railway between Houston and La Porte and Morgan's Point, via Harriburg, and skirting Bay Ridge. The proposed line will be about thirty miles long, it is stated. The names of the parties interested in the project have not been made public. It is stated that their representatives have been busy securing right-of-way and making other preliminary arrangements for building the road. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

LAKE CITY, IA.—The Central Mutual Telephone Company is planning improvements to cost about $20,000. P.

PRINCETON, WIS.—The Princeton Telephone Company has been incorporated with a capital stock of $5,000. P.

CLINTON, OKLA.—The Washita Valley Telephone Company has been incorporated with a capital stock of $15,000.

DALHART, TEX.—The Dalhart Telephone Company has been incorporated in Dalhart, with a capital stock of $15,000. P.

DOVER, DEL.—The New York State Wireless Telegraph and Telephone Company has been incorporated in Delaware with a capital of $2,500,000.

FOLEY, ALA.—The Alabama Telephone and Telegraph Company has been organized to build lines to Galesburg, Seminole, and Somerdale. Ellis L. Munner is president. B.

CLINTON, KAN.—The Washita Valley Telephone Company has been incorporated with a capital of $15,000 by M. L. Holcomb, J. L. Avant, C. E. Gannaway, R. O. Hunt of Clinton and L. L. Covin of Arapahoe.

NEW LONDON, WIS.—The Wisconsin Telegraph Company has a crew of men at work rebuilding its line in this vicinity. About $10,000 worth of material, including over 5,000 pounds of copper wire, goes into the line.

JACKSON, GA.—A telephone line will be built from Jackson to Fincherville and Woodstown, the Southern Bell Telephone and Telegraph Company co-operating. This will be the sixth rural telephone line in Butts county, Ga. B.

GREELEY, COL.—The entire telephone system at Eaton will be taken out to be replaced by the central energy system. All wiring is to be strung along the alleys and cables will replace the single wires. Excavation has begun for a $12,000 building on First street.

OGDEN, U.—Announcement of improvements calling for $60,000 expenditures has been made by the local branch of the Rocky Mountain Bell Telephone Company. Recently the city council ordered the telephone companies, the Utah Light and Railway Company, and the Western Union Telegraph Company to remove their poles from the middle of the streets in the business district within sixty days. This demand on the part of the city has resulted in the announcement of the establishment of a complete underground wiring system by the Bell Telephone Company.

CINCINNATI, O.—The Citizens' Telephone Company recently began the work of putting phone wires under ground. Under its recent franchise the company agreed to lay a mile of the conduit system the first year, the right being reserved to complete the entire system without delay. Seventy-five men were put to work by John B. McLane & Company, contractors, commencing on Fourth avenue at the Licking bridge. The line will run east through James street to York street, thence to Sixth and east to Linden avenue. It will continue to Tenth street, west to Monroe and south to the corporation line. The system will include the entire lengths of York and Monmouth streets, and it is stated by the contractors that over ten miles will be laid before the work is stopped. The work will be finished this summer.

ELECTRICAL SECURITIES.

The financial markets of last week registered a sharp revulsion of sentiment from the hopeful temper of the rising prices the week before. It was the commonly accepted view of close market observers that the advance had been organized as an experiment by important capital and banking interests with a view to stimulating outside interest. The action of the market at the opening of last week was sufficient to demonstrate the failure of this experiment.

A special meeting of the New England Telephone and Telegraph Company will be held in New York city May 2, to vote on increasing the number of directors and amending the by-laws to conform to such increase.

The Portland Electric Company has sold $193,000 first mortgage five per cent sinking fund bonds, due August 1, 1926. These bonds are part of an authorized issue of $1,500,000, of which $1,346,000 have already been issued for improvements and extensions.

The Orange County Traction Company, which operates in Newburgh and Montgomery, N. Y., has asked the up-State Public Service Commission for authority to place a mortgage of $750,000 on its property and issue bonds to the amount of $205,000 thereunder.

The Kansas City Railway and Light Company has sold to J. P. Morgan & Company and Lee, Higginson & Company, $1,000,000 first lien refunding five per cent bonds, due May 15, and $1,375,000 series B five per cent five-year convertible collateral trust notes due September 1, 1912. The proceeds of the sale will be used to retire the floating debt.

N. W. Harris & Company have purchased $2,000,000 Pacific Coast Power Company first mortgage five per cent bonds, due March 1, 1940. This company, in addition to owing water rights near Seattle and Tacoma, owns a majority of the common stocks of the Seattle Electric Company and the Seattle-Tacoma Power Company, the present income being at the rate of more than three and one-half times annual interest charges.

DIVIDENDS.

American Gas and Electric Company; preferred quarterly dividend of one and one-half per cent, payable May 1.

Connecticut Railway and Lighting Company; regular quarterly dividend of one per cent, payable May 15 to stock of record April 30.

Guanajuato Power and Electric Company; preferred dividend of one and one-half per cent, payable May 1.

Mobile Electric Company; quarterly dividend of one and one-half per cent upon the preferred stock, payable May 14 to stock of record April 30.

Portland Gas and Electric; initial preferred dividend of one and three-quarters per cent, payable May 2.

West Penn Railway Company; regular quarterly dividend of one and one-quarter per cent on the preferred stock, payable May 2 to stock of record April 21.

NEW YORK.

	April 25.	April 18.
Allis-Chalmers common	10½	11
Allis-Chalmers preferred	36½	39
Amalgamated Copper	74	78⅜
American Tel. & Cable	*80	*80
American Tel. & Tel.	136¼	137⅞
Brooklyn Rapid Transit	80	80⅜
Brooklyn Rapid Transit	80	80¾
General Electric	150	152
Interborough-Metropolitan common	22¼	23⅛
Interborough-Metropolitan preferred	58⅜	53⅞
Kings County Electric	130	130
Mackay Companies (Postal Telegraph and Cables) common	88⅞	87
Mackay Companies (Postal Telegraph and Cables) preferred	76	76
Manhattan Elevated	135	136
Metropolitan Street Railway	18	18⅝
U. S. Steel common	83⅝	87⅞
U. S. Steel preferred	120¾	122¼
Western Union	70	71¾
Westinghouse common	64¼	68
Westinghouse preferred	*175	115

*Last price quoted.

BOSTON.

	April 25.	April 18.
American Tel. & Tel.	136¼	137⅞
Edison Elec. Illuminating	250	256
General Electric	150	152
Massachusetts Electric common	18	19
Massachusetts Electric preferred	88	88
New England Telephone	134	134
Western Tel. & Tel. common	15½	14¾
Western Tel. & Tel. preferred	87	87

PHILADELPHIA.

	April 25.	April 18.
American Railways	45	45
Electric Company of America	11⅞	11⅞
Electric Storage Battery common	61	62
Electric Storage Battery preferred	61	62
Philadelphia Electric	15½	15½
Philadelphia Rapid Transit	19½	21¾
Philadelphia Traction	86¼	86½
Union Traction	48¼	49¾

CHICAGO.

	April 25.	April 18.
Chicago Railways, Series 1	98	98
Chicago Railways, Series 2	28½	29
Chicago Subway	2⅞	2½
Chicago Telephone	120	128
Commonwealth Edison	114	115
Metropolitan Elevated common	15	15
Metropolitan Elevated preferred	54	52½
National Carbon common	110	112½
National Carbon preferred	118	118

PERSONAL MENTION.

F. E. FLETCHER, assistant manager of the Tampa Electric Company, of Tampa, Fla., was elected president of the Florida Electric Light and Power Association, at the recent convention of that body, held at Tampa.

E. J. KULAS, president of the Tungstolier Company of Cleveland, O., sailed for this country from Europe on April 23. Mr. Kuals' trip was made with the purpose of completing arrangements for handling a line of material new in this country.

R. F. MORRIS, formerly manager of the Colorado Springs branch of the Colorado Telephone Company, has recently been made manager of the Texas division of the Tri-State Telephone Company. Mr. Morris will make his headquarters at El Paso, Tex.

VAN HORN ELY, of Steubenville, Ohio, has recently been selected as head of the Beaver County Traction and Light Company. The Beaver County Traction and Light Company has been assimilated by the Ohio Valley Scenic Route and Mr. Ely will direct the entire business from New Brighton.

FREDERICK T. HEPBURN was recently appointed general manager of the Saginaw-Bay City Railway and Light Companies to take the place of John F. Collins, who resigned. Mr. Hepburn has had many years of experience in the railway business, having been connected with the Pennsylvania Railway Company and later with the Ohio Electric Company and later acting as manager of the Lima City Railway.

JOHN F. COLLINS, newly appointed assistant general manager of the Toledo Railways and Light Company, was tendered a banquet at the Boody House by friends upon his return to Toledo, O. Frederick T. Hepburn, formerly connected with the Ohio Electric at Lima, O., has been selected to fill the position of general manager of the Saginaw and Bay City Railway, succeeding Mr. Collins, who, in addition to his duties as assistant general manager of the Toledo Railways and Light Company, has been made president of several subsidiary interurban roads.

ALLARD SMITH, construction engineer of the Chicago Telephone Company, gave a course of four lectures last week before the senior engineering students at the University of Wisconsin. Mr. Smith's lectures were illustrated in a series of 200 lantern slides. He spoke in detail upon the many problems involved in the design, construction and operation of a large telephone system. It is the intention of this university to have men who have had practical experience assist the regular teaching force, by arranging short lecture courses of this character in all the principal branches of engineering work.

CAPT. W. L. CANDEE.

CAPT. W. L. CANDEE, president of the Okonite Company, returned to New York city last week after an extended sojourn at Bermuda, where he spent some two months resting and recuperating. His many friends throughout the electrical industry will be pleased to learn of his complete restoration to health, and the resumption of his old-time activity. Captain Candee was one of the pioneers in the electrical industry, having been active in the early telephone and electric lighting days. Some twenty-six years ago he took up the manufacture of Okonite insulated wires and cables, which organization, under his management, has met with conspicuous and continued success.

OBITUARY.

JOHN OLDHAM, founder of the Western and River Plata Telegraph Companies, died in Buenos Ayres recently. He was an Englishman, and went to South America in 1866. He laid the first telegraph wire between Buenos Ayres and Uruguay, and had developed practically all of the telegraph facilities of the two countries since that time. Dom Pedro, of Brazil, made him Chevalier of the Order of the Rose for this reason. Before leaving England Mr. Oldham was for a long time with the British Posts and Telegraph, and with the W. T. Hendley Telegraph Cable Works, in London.

GEORGE BAKER, formerly a prominent street car promoter of Toledo, Ohio, died recently at his home after a long illness. Mr. Baker went to Toledo fifty years ago, and was prominent in the development of transportation facilities of that city a quarter of a century ago. He was president of the old Metropolitan Street Car Company, which was incorporated in 1872, and constructed several of the more important lines in the city. In 1876 he took entire change of the company and extended its lines, marking the beginning of a new era in the street car business of that section. He is survived by four daughters.

PROPOSALS.

POST OFFICE, CATLETTSBURG, KY.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until May 19 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States post office and court house at Catlettsburg, Ky., in accordance with drawings and specifications, copies of which may be had from the custodian at Catlettsburg, Ky., or at the Supervising architect's office.

POST OFFICE, KOKOMO, IND.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until May 20, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States post office at Kokomo, Indiana, in accordance with drawings and specification, copies of which may be obtained from the Custodian of site at Kokomo, Ind., or at the Supervising Architect's office.

POST OFFICE, HIGH POINT, N. C.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids until May 17 for the construction complete (including plumbing, gas piping, heating apparatus and electric conduits for wiring), of the United States post office at High Point, North Carolina, in accordance with drawings and specifications, copies of which may be obtained from the custodian of site at High Point, N. C., or at the Supervising Architect's office.

NAVY DEPARTMENT SUPPLIES.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will open bids on naval supplies on the dates given below. Bidders interested therein should make early application for copies of the schedule, giving the schedule numbers desired. Schedules can be obtained from the Navy Pay Office nearest each navy yard. Bids will be asked on the following supplies: '.

Date of Opening.	Material.	Quantity.	Place of Delivery.	Schedule No.
May 10—	Cable, copper	1,200 feet	Washington, D. C.	2427
	Cable, single-conductor	21,000 feet	Newport, R. I.	2427
	Cable, telephone	3,500 feet	Portsmouth, N. H.	2425
	Cable and wire, telephone	11,000 feet	Brooklyn, N. Y.	2425
	Fixtures, electric	Miscellaneous	Annapolis, Md.	2430
	Lamps, mercury vapor	Miscellaneous	Washington, D. C.	2427
	Motors, induction	400	Washington, D. C.	2427
	Starters, automatic, etc.	24	Brooklyn, N. Y.	2426
	Switchboard, etc.	Miscellaneous	Brooklyn, N. Y.	2426
	Transformers, oil-cooled	23	Washington, D. C.	2427
	Drills, electric, portable	Miscellaneous	Charleston, S. C.	2434
	Drills, electric, radial	12	Brooklyn, N. Y.	2431
	Drills, electric, hand	12	Brooklyn, N. Y.	2431

INDUSTRIAL ITEMS.

THE CENTERFREZE ICE PROCESS COMPANY, New York, N. Y., announces the removal of its offices to the Whitehall Building, 17 Battery Place.

THE MACBETH-EVANS GLASS COMPANY, Pittsburg, Pa., is distributing catalogue No. 38, on glassware for gas and electric fixtures. The catalogue is well bound in cloth and contains a very complete line of attractive globes and reflectors.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., is distributing to the trade a folder explaining the distinction between "Sherarduct" and ordinary galvanized conduit. Two buildings are shown, in which "Sherarduct" is exclusively installed.

THE R. H. WILLIAMS CEDAR COMPANY announces that it has succeeded to the business of the firm of Robert H. Williams, dealer in cedar poles, ties, piling and spars, cedar and fir timbers, and that the main office of the concern has been moved to 75 Hutchinson Block, 429 Pender Street, Vancouver, B. C.

THE ROBBINS & MYERS COMPANY, Springfield, O., is mailing a booklet on the subject of electric fans. The novel feature of this booklet, which contains illustrations of many types of Robbins & Myers fans, is that it is prepared so that it may be sent out either as an enclosure or as a card with a one-cent stamp.

THE NATIONAL CONDUIT AND CABLE COMPANY, New York, N. Y., in the April 20 issue of *Copper Gossip* mentions the fact that a number of companies are preparing for busy times. The copper market is spoken of as being somewhat demoralized because the output of metal is considerably greater than the consumption.

THE OHIO BRASS COMPANY, Mansfield, O., in its April issue of the O-B Bulletin shows an illustration of the O-B trolley wire pick up. The convenience of the little device is quite fully treated. Mention is also made of the company's new general catalogue, which is now on the press and will be mailed to its electrical railway and electrical engineers list early in May.

THE ESTERLINE COMPANY, Lafayette, Ind., J. W. Esterline, president and manager, have been retained as the consulting and supervising engineers of the Bedford Power Company, which proposes to construct a hydroelectric plant on the south fork of the White River, near Williams, Ind., and transmit several thousand horsepower to the stone district of Bedford, Indiana.

THE DUPLEX METALS COMPANY, New York, N. Y., is mailing a folder giving an example of one company's repeat orders. The Great Northern Railway Company, which is the case taken, began as a customer about two years ago with an order for 413 miles of wire. Since that time it has given several orders, which as the folder shows amount to a total of nearly 5,000 miles.

THE BENJAMIN ELECTRIC COMPANY, Chicago, Ill., has prepared and is mailing bulletin No. 5 in which are included the most recent devices for the use of Mazda lamps. Representative requirements for in and out-door service have been taken into account and corresponding ceiling and other pendant fixtures together with a number of accessories are incorporated in the bulletin.

PETTINGELL-ANDREWS COMPANY, Boston, Mass., tells something of the profits that may be made from fan customers, in the April number of its monthly publication, "Juice." The new fan catalogue is, it announces, now off the press. In the front of the booklet appears a copy of "New England's Call to Arms," which was written for the Pilgrim Publicity Association of Boston, an organization pledged to upbuild New England through publicity.

THE RATHBONE FIREPLACE COMPANY, Grand Rapids, Mich., announces that the fire which visited its finished goods department did not do enough damage to affect the immediate filling of orders for this company's line of goods. The company announces that it is ready to fill orders just as promptly as ever before and does not want the trade to think that orders will be held up.

THE ELMER P. MORRIS COMPANY, 90 West Street, New York city, manufacturer of lamp posts and lighting specialties for exterior work, is erecting a large factory at Elizabethtown, Pa. Upon its completion the present factory at Newark, N. J., is to be closed down. Although the new factory has a capacity of several times that of the old one, it will take several months to complete orders on hand.

THE TRIUMPH ELECTRIC and THE TRIUMPH MACHINE COMPANIES, Cincinnati, Ohio, have issued invitations inviting their friends to be present at an inspection of their New Oakley plant. The plant will be inspected on the afternoon of April 30 by the Business Men's Club, the Chamber of Commerce, the Manufacturers' Club, the Cincinnati Industrial Bureau, and the Cincinnati Metal Trades Association.

THE "RAY D. LILLIBRIDGE, INCORPORATED," has been formed, with Ray D. Lillibridge and William L. Richard constituting the organization. New and enlarged offices have been secured at 192 Broadway, New York, in the Chatham National Bank Building. Among the clients whose advertising is handled are the Wagner Electric, International Steam Pump, Dodge & Day, Robins Conveying Belt, Denver Rock Drill, etc.

THE D. & W. FUSE COMPANY, Providence, R. I., is mailing circulars 112 and 113, covering service switches and fuse boxes for National code fuses and fuses and cutouts for inductive circuits. The price list supplement which accompanies these circulars covers the latest types of secondary fuse boxes and service switches and transformer and junction cutouts, for aerial and subway lines.

THE COLONIAL ILLUMINATING COMPANY—Robert C. Finch, consulting engineer of this company—is developing a new tungsten lamp which is being demonstrated by Dr. I. Kitsee, of Philadelphia. The new lamp will probably be ready for the market by July 1. Mr. Finch is greatly pleased with the tests so far made and expects to have a lamp that will rate at one watt per candlepower and possess a filament as strong as the carbon filament. The lamp, it is believed, will have an unusually long life.

THE NATIONAL ELECTRIC LAMP ASSOCIATION has issued bullet in 7A, on "Mazda" incandescent street lighting. The historical development of series incandescent lighting is treated in a very interesting manner. Considerable data is given on tests of the lamps and distribution curves obtained with various reflectors are shown. The information contained in the bulletin is designed especially to be of interest to municipal lighting committees and superintendents of municipal plants, and in fact anyone who is concerned with the problem of better illumination.

THE EVERSTICK ANCHOR COMPANY, St. Louis, Mo., makers of the well-known "Everstick" anchors, is now building a new factory at 1624 North 8th Street, St. Louis, which will be especially adapted for the manufacture of this product. This is the third time that the Everstick company has been obliged to change its quarters, having each time outgrown its former quarters. The Everstick anchor has met with universal approval, and is being used by a great many electric light, telephone and telegraph companies. The Everstick company states that its business is making rapid strides and that the Pacific Coast states district is coming to the front rapidly. The company has just secured a two-carload order from a San Francisco supply house and the prospects from California alone indicate a minimum business of a carload a month.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., has recently issued bulletin No. 1,005, which is the third of a series of nine bulletins on telephone exchange apparatus which is to be issued. This bulletin is entitled "Branch Exchange Switchboards of Lamp Signal and Magnetic Signal Types." It describes the types of branch exchange equipments which have been designed for use in business establishments, factories, schools and places where a modern private telephone system is required. The material contained in the bulletin is divided into sections, each section treating some particular part of the branch exchange equipment,

such as lamp signal, line circuit apparatus, cord circuits, ringing circuit apparatus, trunk circuit apparatus, etc. The back part part of the bulletin is given to illustrations of the different types of switchboards.

THE WESTINGHOUSE ELECTRIC COMPANY, Pittsburg, Pa., is furnishing a 500-kilowatt steam turbine driving a 2,300-volt alternator, to the Leavenworth (Kansas) Light, Heat and Power Company. The turbine is of the high pressure type, taking steam at 150 pounds pressure, and exhausting into a Leblanc condenser which maintains a vacuum of twenty-eight inches. The service rendered by the new equipment will be similar to that of the machines already installed; operating in parallel with the present three-phase, sixty-cycle, 2,300-volt distribution system. Other sales of turbo units have also been made.

DATES AHEAD.

Nebraska Electrical Association. Annual convention, Lincoln, Nebr., May 3, 4 and 5.

American Electrochemical Society. Annual Convention, Pittsburg, Pa., May 5, 6 and 7.

Southwestern Electrical and Gas Association. Annual meeting, Beaumont, Tex., May 10, 1910.

Ohio Mechanical, Electrical and Steam Engineers' Association. Next meeting, Cincinnati, Ohio, May 10.

Oklahoma Public Utilities Association. Next meeting, Sapulpa, Okla., May 9, 10 and 11.

Pacific Coast Electrical Exposition, San Francisco, Cal., May 21, 1910.

National Electric Light Association. Annual convention, St. Louis, Mo., May 23-28.

Maine Electrical Society. Next meeting, Portland, Me., May 25.

Mississippi Electric Association. Annual convention, Greenville, Miss., June 15 and 16.

American Institute of Electrical Engineers. Annual convention, Waumbeck Hotel, Jefferson, N. H., June 27, 28, 29 and 30.

Michigan Electrical Association. Annual convention, Port Huron, Mich., August 16, 17 and 18.

Colorado Electric Light, Power and Railway Association. Next convention, Glenwood Springs, Colo., September 21, 22 and 23.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) April 19, 1910.

955,126. ELECTRICAL DISTRIBUTING-BOARD. Henry J. Blakesles, Utica, N. Y. Filed June 5, 1907. A distributing board comprises a base of insulating material having apertures therethrough, a busbar on one face of the base, a circuit terminal mounted independent of the base on the opposite side thereof, and a plug adapted to be held in the aperture and to make electrical connection through a fuse contained therein from the busbar to the terminal.

955,134. SELECTIVE LOCKING-KEY. John F. Cadell, Baltimore, Md., assignor to the North Electric Company, Cleveland, Ohio. Filed May 20, 1907. Contacts are closed by cams on the flat back of reciprocating spring-actuated plungers.

955,137. CONTROLLER FOR ELECTRIC MOTORS. William M. Connelly, Chicago, Ill., assignor to the Electric Controller and Manufacturing Company, Cleveland, Ohio. Filed January 26, 1910. Comprises a magnetically operated switch having contacts in the circuit, a second switch also having contacts in the circuit, a third switch having contacts for governing the magnet of the first switch, and a lost-motion connection between the second and third switches, by means of which the third switch may operate to open the circuit of the winding of the first switch before the contacts of the second switch are separated.

955,141. ANTI-INDUCTION DEVICE. Minor M. Davis, New York, N. Y. Filed July 14, 1909. An anti-inductive arrangement of conductors in inductive relation with respect to a conductor carrying disturbing current impulses, consists of an insulated conductor in circuit with suitable signaling instruments, a parallel, idle conductor, in substantially fixed relation to the last-named conductor and an adjustable capacity connected to the idle conductor.

955,142. DEVICE FOR PREVENTING INDUCTION IN ELECTRICAL CONDUCTORS. Minor M. Davis, New York, N. Y. Filed July 17, 1909. The means for neutralizing the effect of inductive impulses in a conductor carrying a disturbing current on a signaling conductor in inductive relation thereto, consists of a signaling conductor, a compensating conductor in inductive relation to a disturbing conductor, a compensating conductor in inductive relation to the signaling conductor, and a variable source of electromotive force in the last-named compensating conductor.

955,154. SWITCH USED WITH ELECTRIC MOTORS. Harry C. Grant, Bayonne, N. J., assignor to the Lionel Manufacturing Company. Filed June 6, 1908. A switch for an electric motor comprises a lever having a cylindrical bushing mounted thereon, a plurality of conducting segments mounted on the bushing, a ring of insulating material encircling the bushing and segments, a plurality of sheet-metal switch members fastened to the ring, the inner ends of which are bent in U-shaped form to serve as springs and abutting the conducting segments, and means for holding the ring to the motor frame.

955,167. RECORDING DEVICE. Carl L. Jaeger, Mahwah, N. J. Filed June 28, 1909. A cylindrical record sheet passes between a radial conductor and an annular conductor in the same plane surrounding the radial conductor, and electric sparks may be caused to pass between the conductors.

955,171. EXCITING-ALTERNATOR. Charles H. Kicklighter, Newberry, S. C. Filed November 9, 1908. Describes a combination of alternator (having direct-current field windings and polyphase armature windings) and converter.

955,185. HANGER FOR TROLLEY-WIRES. William A. McCallum, Cincinnati, Ohio. Filed May 24, 1909. A suspending hanger for trolley wires.

955,190. ATTACHMENT FOR TELEPHONES. John W. Nilsson, Balfour, N. D. Filed May 8, 1909. A governor regulates the speed of an audible signaling mechanism.

955,191. RESISTANCE-THERMOMETER. Edwin F. Northrup, Morris E. Leeds and Charles R. Cary, Philadelphia, Pa., assignors to Leeds & Northrup Company. Filed November 21, 1908. A temperature-measuring apparatus utilizes a Wheatstone bridge and its source of current, etc.

955,192. ELECTRIC SIGNALING DEVICE FOR MOTOR-CARS. Joseph L. Palous, Berlin, Germany. Filed April 13, 1908. An electric signal comprises a support, a flat spring secured thereto, an electromagnet secured by one core end to the spring, a stationary sounding body adjacent the free core end of the electromagnet acting as its armature, a circuit interrupter comprising a contact point co-acting with the spring and an electric circuit connected with the magnet and interrupter.

955,204. CURRENT-CONTROLLING MECHANISM FOR INTERNAL-COMBUSTION ENGINES. Lewis T. Rhoades, Mont Clare, Pa. Filed August 18, 1909. Describes an accelerator.

955,215. STREET-INDICATOR. Edward C. Schwartz, Portland, Ore. Filed October 20, 1908. Means associated with the trolley head make a circuit through relays and solenoids successively to present indicating strips to view.

955,253. HARMONIC SELECTIVE-RINGING SYSTEM FOR PARTY-LINES. Hiram D. Currier, Bloomfield, N. J., assignor to Western Electric Company, Chicago, Ill. Filed May 5, 1909. Relays of predetermined frequencies are used.

955,263. SWITCHBOARD CONSTRUCTION. Theodore A. Hammond, Passaic, N. J. Filed August 5, 1904. Describes a switchboard jack.

955,268. ELECTRIC MACHINE. Gustaf O. Holmgren, Vesterås, Sweden. Filed January 3, 1910. An electric machine has a rotor with projecting pole pieces and windings on the latter, the axial parts of which are curved substantially as a chain line.

955,302. TELEPHONE SIGNAL-BELL. Herman L. Wuerffel, Maywood, Ill., assignor to Western Electric Company, Chicago, Ill. Filed March 26, 1910. Comprises an electromagnet with its armature, a mounting plate secured adjacent thereto, a support for the armature rotatably carried by this plate, a cam for adjusting the support with respect to the plate, and a locking device for holding the support in its adjusted position.

955,323. CIRCUIT-CLOSER. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed July 2, 1904. Comprises a receptacle having a U-shaped chamber, a relatively stationary contact arranged therein, a compression tank having fluid under a substantially constant pressure conected with one leg of the chamber, the other leg of the chamber being connected with a reservoir in which the pressure varies, a current-conducting liquid arranged in the chamber and moved by the pressures in the reservoirs, the liquid responding when a predetermined difference between the pressures in the reservoirs occurs.

955,335. BRIDGING-TELEPHONE SYSTEM. Henry F. Joeckel, Clayton, Ill. Filed July 27, 1907. A magneto telephone system.

955,360. METHOD OF MANUFACTURING SUBSTANCES OF HIGH RESISTANCE. Alfred Schlomann, Munich, Germany,

assignor to Vakuum Pressgut Gesellschaft m. b. H., Berlin, Germany. Filed August 4, 1906. A process of manufacturing moisture-resisting insulating substances consists in mixing asbestos fibers with a liquefied resin, and drying the mixture by pressing, heating and evacuating it simultaneously.

955,391. ELECTROMAGNETIC SWITCH-OPERATING MECHANISM. George W. Donnan, Schenectady, N. Y., assignor to Kendrick Railway Switch Company, Schenectady, N. Y. Filed October 6, 1909. A movable tongue is electromagnetically controlled.

955,402. RAILWAY SIGNALING SYSTEM. Lemuel F. Howard, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Filed September 8, 1909. A selective rail bond for a railway signaling system comprises a condenser and an inductive winding.

955,438. SCREW-PLUG ELECTRICAL RECEPTACLE. Frank J. Russell, Brooklyn, N. Y. Filed October 25, 1909. A side-plug contact for an electrical receptacle consists of spaced crimped metal strips arranged parallel to the axis of the receptacle body, the crimps of the separate strips being in complemental screw-thread relation to form a receiving thread for the electrical plug.

955,442. MACHINE FOR FORMING INCANDESCENT-LAMP MOUNTS. Edward Simon, Shelby, Ohio, assignor to General Electric Company, Schenectady, N. Y. Filed December 14, 1904. The machine comprises a heater, a rotatable support for the mount tube, means for forming the mount, and an anchor-wire support, the anchor-wire support forming means being rotatable with the mount tube support.

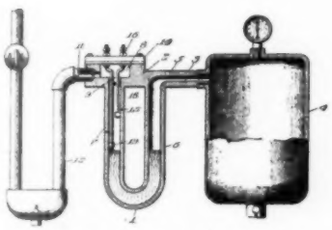
955,447. SYSTEM OF ELECTRICAL DISTRIBUTION. Joseph L. Woodbridge, Philadelphia, Pa. Filed October 22, 1906. The system includes two alternating-current dynamo-electric machines connected in parallel, a winding embracing a magnetic circuit connected between them, a consumption circuit, means for connecting the consumption circuit to an intermediate point in said winding and a supply of energy for one of the machines controlled by changes in its phase relation to the other.

955,461. METHOD OF MANUFACTURING FILAMENTS FOR INCANDESCENT LAMPS. John W. Howell, Newark, N. J., assignor to General Electric Company. Filed August 13, 1904. The method of producing filaments consists in firing an untreated filament at a high temperature sufficient to drive off some of the volatile ash in the base, then treating the filament, and then firing the treated filament at a still higher temperature.

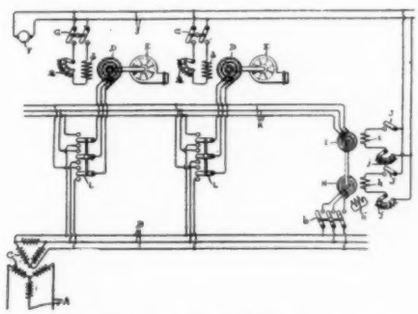
955,465. SOCKET AND ATTACHING-PLUG. John Luther, Schenectady, N. Y., assignor to General Electric Company. Filed July 13, 1907. A lamp socket comprises a base, a pair of exposed contact fingers projecting from the rear end of the base, lamp-engaging contacts on the front end of the base respectively conected to the contact fingers, binding posts for connecting branch wires to the contacts, and a detachable insulating cover over the binding posts through which the contact fingers extend and operating to sustain the branch wires.

955,472. COMBINED TELEPHONE AND PROTECTIVE ALARM SYSTEM. James G. Nolen, Chicago, Ill., assignor to John E. Shepherd, Chicago, Ill. Filed May 31, 1907. A self-operating electric circuit-changer on the line operates to vary the conditions in the line in a manner detectable in the receiver of the central operator. It is short-circuited at predetermined intervals.

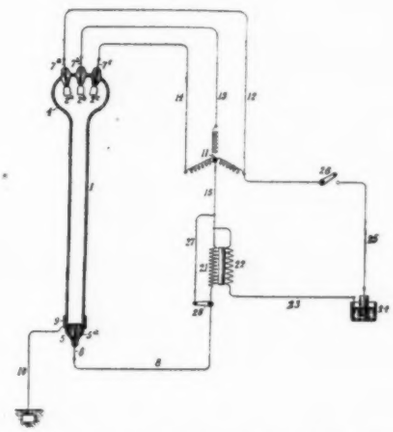
955,479. VULCANIZER. Clarence A. Shaler, Waupun, Wis. Filed June 15, 1907. A vulcanizer comprises a casing, an electric heating device within the casing adapted to conduct a continuously flowing current and means theremostatically controlled to automatically regulate the resistance for the continuously flowing current in the heating device.



955,323.—CIRCUIT CLOSER.



955,455.—MEANS FOR STARTING ALTERNATING-CURRENT MOTOR.



955,459.—APPARATUS FOR TRANSMITTING AND USING ELECTRIC CURRENTS.

955,448. MEANS FOR OPERATING END-CELL SWITCHES. John W. Achard, Philadelphia, Pa. Filed March 21, 1905. An end-cell switch-driving mechanism comprises a movable member constituting a motor starting and reversing controller and provided with high and low parts, a cam and its follower, and a spring bolt carried by the follower and adapted to co-operate with the high and low parts to lock the movable member in two positions.

955,455. MEANS FOR STARTING ALTERNATING-CURRENT MOTORS. William J. Foster, Schenectady, N. Y., assignor to General Electric Company. Filed November 3, 1908. On combination with a main alternating-current motor and its supply circuit, a small motor-generator set comprising two synchronous machines of the same frequency, means for connecting the motor of said set to the supply circuit, and means for connecting the main motor first to the generator of said set and then to the supply circuit.

955,459. APPARATUS FOR TRANSMITTING AND UTILIZING ELECTRIC CURRENTS. Peter C. Hewitt, New York, N. Y., assignor to Cooper-Hewitt Electric Company. Filed April 5, 1901. A current-rectifying apparatus comprises a negative electrode and a plurality of positive electrodes, means for overcoming the electrode reluctance at the negative electrode, and for maintaining this condition at the negative electrode.

955,460. METHOD OF TRANSMITTING AND UTILIZING ELECTRIC CURRENTS. Peter C. Hewitt, New York, N. Y., assignor to Cooper-Hewitt Electric Company. Filed April 5, 1901. The method of producing light by means of polyphase electric currents consists in transmitting through the light-giving medium electric currents in one direction due to the electromotive forces impressed in that direction upon the respective circuits from the source and availing of the negative electrode reluctance for opposing the flow of current in another direction.

955,484. ELECTRIC DENTAL ENGINE. John V. Trenaman, Newark, N. J. Filed January 8, 1908. An electric motor of compact design is included in a cord-suspended member.

955,508. ELECTROHYDRAULIC ELEVATOR SYSTEM. Ethelbert M. Fraser, Yonkers, N. Y. Filed December 19, 1908. An electrohydraulic differential elevator system comprises a hydraulic motor and two pumps embraced in a fluid-circulating system, and means whereby the hydraulic motor is operated by the differential discharge of the pumps.

955,521. PUSH-BUTTON. Dimmitt R. Lovejoy, Irvington, N. Y. Filed July 30, 1907. Comprises an insulating base having three holes, contact springs mounted in two of the holes and retained therein solely by their configuration, a circuit-closing tongue adapted to play freely in the third hole and to make contact with the springs, and a bent wire piece detachably secured across the back of the base and passing through a slot in the circuit-closing tongue for the purpose of limiting the movement of the tongue.

955,522. ELECTRIC HAMMER. Cecil C. Lutes, Noxen, Pa. Filed November 5, 1909. A hammer armature operates between opposed magnets.

955,598. ELECTRICAL HEATER. Royal Lares, St. Paul Park, Minn. Filed April 6, 1909. An electrical heater comprises an inclosing radiator frame, a core within the frame, an electrical insulating liquid between the core and frame and an electrical resistance conductor wound on the core, the liquid acting as a medium in intimate contact with the conductor core and frame to transmit heat.

955,618. ELECTRIC IGNITION SYSTEM FOR EXPLOSION-MOTORS. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. Filed September 23, 1905. The circuits of the primary windings of the generator are broken successively while the external circuit of the generator is never broken.

955,633. TELEPHONE SYSTEM. Merritt S. Conner, Oakdene, Hale, England, assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Original application filed January 23, 1907. Divided and this application filed July 1, 1908. A party-line telephone system.

955,636. ELECTRIC SIGNAL-BELL. Harold W. Eden, Detroit, Mich. Filed March 1, 1907. A unitary armature and bell hammer is made from a single bar of metal, one end being left in its naturally soft and untempered condition, and the other end being swaged and compressed, and therby hardened and made resilient.

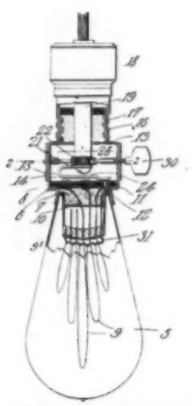
955,655. ELECTRIC FURNACE. Einar H. Meyer and Job M. A. Stillesen, Niagara Falls, Ontario, Canada. Filed March 20, 1908. An electric furnace has a bottom electrode, an inclined top electrode, and means for securing uniform wear of the inclined electrode.

955,661. INSULATOR. William E. Moore, Connellsville, Pa. Filed February 25, 1905. A wire-supporting petticoat insulator.

955,676. TELEGRAPH-SOUNDER. George F. Oehmen, New York, N. Y. Filed January 21, 1909. A signaling apparatus comprises a vertical solenoid, a straight vertical core movably suspended therein, and means directly mounted upon and in axial alinement with the core for producing signals.

955,685. TELEPHONE-TRANSMITTER. George N. Quinby, Jr., North Providence, R. I. Filed July 24, 1909. The casing is provided with spaced electrodes and an interposed body of granular material.

955,693. ELECTRICAL CONTROLLING MECHANISM FOR WEIGHING-MACHINES. Henry Richardson, New York N. Y. Filed July 2, 1908. A toggle-locking member is electromagnetically unlocked by means of a hammer blow.



955,748.—SECTIONAL INCANDESCENT LAMP.

955,716. TELEPHONE TRANSMITTER. Pietro Stragiotti, Hurley, Wis. Filed August 11, 1908. A differential microphonic transmitter.

955,742. TROLLEY-WHEEL REPLACER. John W. Anderson, Hamilton, Ontario, Canada, assignor of one-half to Allith Manufacturing Company, Limited, Hamilton, Canada. Filed February 25, 1909. In combination with the hollow extensions and trolley wheel interposed between them provided with a suitable bushing, is a hollow axle having orifices opposite the bushing and at the outside of the bushing, and wicking extends through the orifice and hollow axle into the hollow extensions which contain oil.

955,748. SECTIONAL INCANDESCENT LAMP. George E. Bill and Albert D. Redman, Sr., Harrisburg, Pa. Filed September 24, 1908. A lamp having a sectional cap is provided with a plurality of filaments, stationary contacts connected to the filaments, a pin depending from the cap and having a threaded socket formed in its lower end, a screw (engaging the threads of the socket and provided with an enlarged head) having an intermediate portion thereof devoid of threads, a gear wheel mounted for rotation on the unthreaded portion of the screw, and a movable contact carried by the gear to engage the stationary contact.

955,753. ELECTRIC RAILWAY. Harry C. Brown and Bert A. Harris, Bloomington, Ill. Filed November 19, 1906. A third-rail system.

955,763. APPARATUS FOR RAISING SUNKEN VESSELS. Bainbridge P. Clark, Elizabeth, N. J. Filed March 18, 1909. An apparatus for raising a sunken vessel comprises a chain or cable adapted to be lowered around the vessel, and means for positioning the chain or cable around and adjacent to the vessel comprising an electrical magnet secured to the chain or cable, and means for energizing the magnet when in a lowered position.

955,777. SAFETY DEVICE FOR ELECTRIC LAMPS. Carl W. Eisemann, Kansas City, Mo. Filed April 16, 1909. In combination of supporting members are a filament supported thereby and a conducting wire slightly oxidized and adapted to be fused thereto when the current through the wire is increased by the breaking of the filament.

955,793. ELECTRICAL MUSCULAR EXERCISING-MACHINE. William Harris, Buffalo, N. Y. Filed June 12, 1906. Comprises a suitable frame, an electric generator secured thereto, spiral springs extensible on the frame, spring retainers secured to the frame and having each a spiral groove into which the convolutions of the springs at one end thereof are threaded, and electric-conducting and operating cords connected to the springs in a manner to cause extension thereof and having connection with the generator to actuate the same.

955,806. SUBSTATION PROTECTOR UNIT. William Kaisling, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. Filed December 11, 1905. A thermal protector unit for telephone lines.

955,818. OZONIZER. Anthony Lohman, Philadelphia, Pa., assignor to W. W. Gibbs, Philadelphia, Pa. Filed January 26, 1909. An ozonizer comprises a casing having at one end an inlet and at the other end an outlet, dielectrics consisting of plates extending from side to side of the casing and stopping short of the ends thereof to provide chambers, dischargers interposed one between each pair of dielectrics with space between and of less area than the latter and consisting of imperforate plates provided with terminals, insulating strips interposed between the dischargers and dielectrics, and electrical connections connecting the alternate dischargers in one series and the intermediate dischargers in another series.

955,820. OUTLET-BOX. Norman Marshall, Newton, Mass., assignee to Arrow Electric Company, Hartford, Conn. Filed October 31, 1908. An outlet box is provided with movable connecting plates for receiving the securing devices of electric fittings, and means conecting the plates for simultaneous adjustment.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired April 25, 1910.

495,996. CLOSED-CONDUIT ELECTRIC RAILWAY. William P. Patton, New York, N. Y.

496,019. ELECTRIC SOLDERING. Elihu Thomson, Lynn, Mass.

496,020. SYSTEM OF ELECTRIC DISTRIBUTION. Elihu Thomson, Swampscott, Mass.

496,041. ELECTRO-MECHANICAL BLOCK-SIGNALING APPARATUS, Murray Corrington, New York, N. Y.

496,060. ELECTRICAL STOP-MOTION FOR KNITTING-MACHINES. George J. Manderfield, Royersford, Pa.

496,067. ELECTRIC ALARM FOR TANKS. Frederic C. Skelton, Montreal, Canada.

496,076. SIGNALING APPARATUS. Hermann Wetzer, Pfronten, Germany.

496,081. INSULATOR. Joseph F. Wright, Colorado Springs, Colo.

496,103. ELECTRIC CIGAR-LIGHTER. Lawrence T. Smith, Barrington, R. I.

496,126. STORAGE BATTERY. Frederick A. LaRoche, Philadelphia, Pa.

496,134 and 496,135. ELECTRIC SYNCHRONIZER FOR CLOCKS. Henry S. Prentiss, Elizabeth, N. J.

496,207. ELECTRIC REPORTER. Major D. Porter, Brooklyn, N. Y.

496,212. ELECTRIC CONVERTER. William Stanley, Jr., Great Barrington, Mass.

496,224. DIAPHRAGM-HOLDER FOR TELEPHONES. Silas W. Holman, Boston, Mass.

496,228. DRY BATTERY. Hugo Koller, Vienna, Austria-Hungary.

496,244. ELECTRO-GALVANIC ADHESIVE PLASTER. Frederick A. Barret, St. Louis, Mo.

496,258. ELECTRIC PROGRAM-CLOCK. Henry C. Hain, Booneville, Mo.

496,280. ELECTRIC-RAILWAY TROLLEY. Wesley W. Pritchett, Ogden, Utah.

496,307. COMBINED DYNAMO-ELECTRIC MACHINE AND WATER MOTOR. John O. Heinze, Jr., Lynn, Mass.

496,308. CUT-OUT AND CIRCUIT-PROTECTOR. John O. Heinze, Jr., Lynn, Mass.

496,312. ELECTRIC MEASURING-INSTRUMENT. Rudolph M. Hunter, Philadelphia, Pa.

496,329. TELPHER SYSTEM. Charles J. Van Depoele, Lynn, Mass.

496,330. ELECTRIC LOCOMOTIVE. Charles J. Van Depoele, Lynn, Mass.

496,331. ELECTROMAGNETIC RECIPROCATING PUMP. Charles J. Van Depoele, Lynn, Mass.

496,366. ELECTRIC-LIGHT DISPLAY SYSTEM. Daniel McF. Moore and Charles M. Jacobs, New York, N. Y.

496,371. ELECTRIC METER. Francis Teague, London, Eng.

496,382. CONTROLLING DEVICE FOR ELECTRIC ELEVATORS. Charles E. Moore, Boston, Mass.

496,386 and 496,387. ELECTRIC-ARC LAMP. William H. Akester, London, Eng.